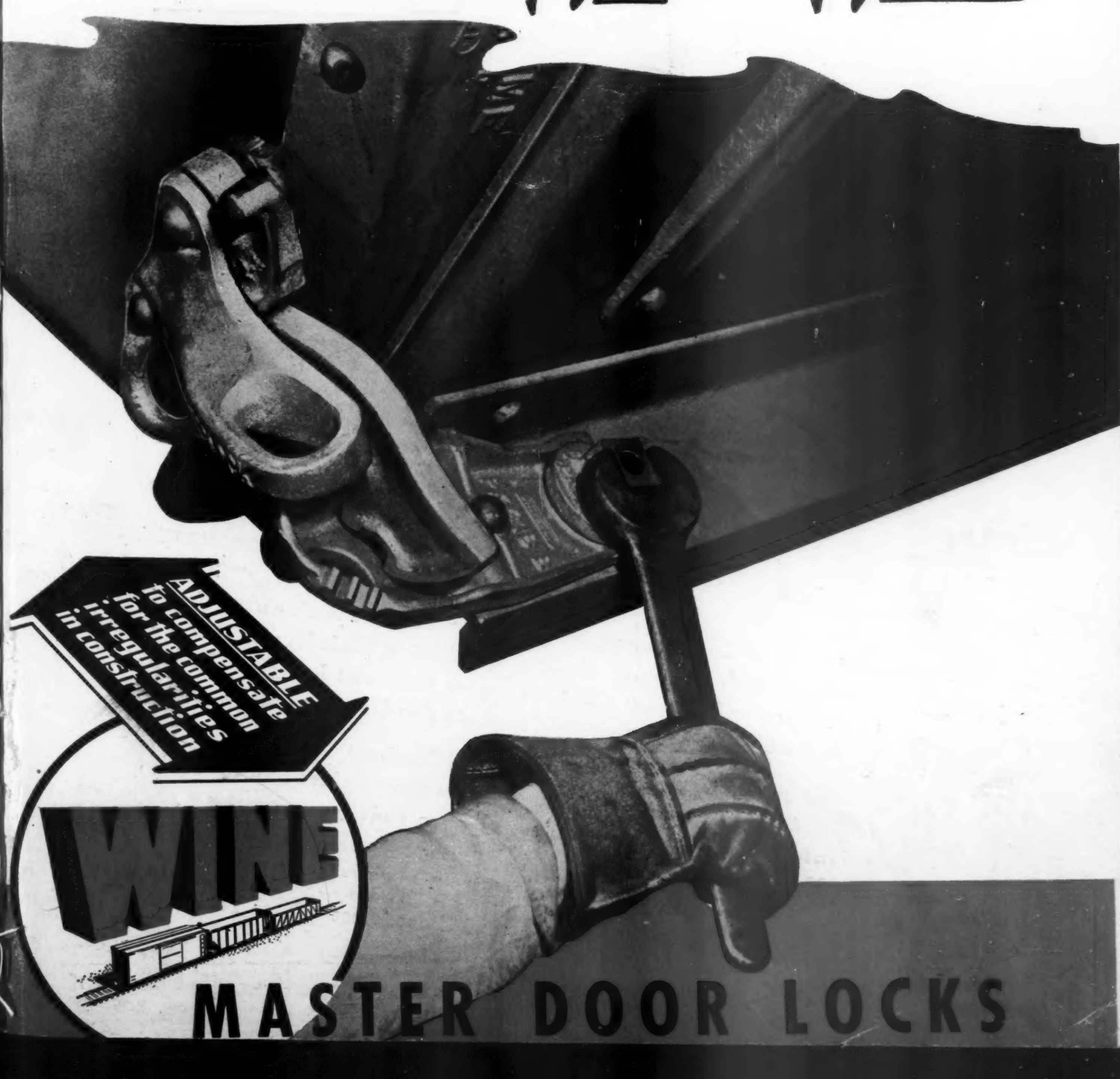
Railway Mechanical Engineer

January
1946



Published monthly by Simmons-Boardman Publishing Corporation, 1309 Noble Street, Philadelphia, Pa. Entered as second-class matter, April 3, 1933, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription price, $3.00 for one year, U. S. and Canada. Single copies, 35 cents. Vol. 120, No. 1.

Transp. Lib.

RAILWAY MECHANICAL ENGINEER

(Name Registered, U. S. Patent Office)

With which is incorporated the RAILWAY ELECTRICAL ENGINEER.

Founded in 1832 as the American Rail-Road Journal

***Attention!* 1945 Indexes**

Please send in your request immediately for the index. Copies are sent only to those who write for them. Those who received the 1944 index are already on the mailing list.

Published on the second day of each month by

Simmons-Boardman Publishing Corporation

1309 Noble street, Philadelphia, Pa. Editorial and Executive Offices: 30 Church street, New York 7, and 105 West Adams street, Chicago 3. Branch offices: Terminal Tower, Cleveland 13; 1081 National Press bldg., Washington 4, D. C.; 1038 Henry bldg., Seattle 1, Wash.; 300 Montgomery street, Room 805-806, San Francisco 4, Calif.; 560 W. Sixth street, Los Angeles 14, Calif., 4518 Roland avenue, Dallas, Tex.

SAMUEL O. DUNN, *Chairman of Board, Chicago;* HENRY LEE, *President, New York,* ROY V. WRIGHT, *Vice-Pres. and Sec., New York,* FREDERICK H. THOMPSON, *Vice-Pres., Cleveland;* FREDERICK C. KOCH, *Vice-Pres., New York;* ROBERT E. THAYER, *Vice-Pres., New York;* H. A. MORRISON, *Vice-Pres., Chicago;* J. G. LYNE, *Vice-Pres., New York;* H. E. MCCANDLESS, *Vice-Pres., New York;* JOHN T. DEMOTT, *Treas. and Asst. Sec., New York.*

The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.), and is indexed by the Industrial Arts Index and also by the Engineering Index Service. PRINTED IN U. S. A.

Subscriptions, payable in advance and postage free, United States, U. S. possessions and Canada; 1 year, $3; 2 years, $5. Foreign countries: 1 year, $4; 2 years, $7. Single copies, 35 cents. Address H. E. McCandless, circulation manager, 30 Church street, New York 7.

JANUARY, 1946

Volume 120 *No. 1*

RAILWAY
MECHANICAL ENGINEER

P. R. R. Q-2 Locomotives

Freight power, with 4-4-6-4 wheel arrangement, has tractive force of 100,800 lb. and is built with boiler capable of evaporating 137,479 lb. of water per hour at 57.4 m.p.h.

THE Pennsylvania Railroad recently completed at its Altoona, Pa., Works the last of 26 locomotives of the 4-4-6-4 non-articulated type. These locomotives, known as the Class Q-2, were designed by the railroad's engineering staff, for fast and heavy freight service.

The four-cylinder, rigid frame locomotive has been studied by the Pennsylvania for several years. The 6-4-4-6 passenger locomotive exhibited at the New York World's Fair was the first to go in service on the Pennsylvania, and was soon followed by the Q-1 freight locomotive, and later by the 4-4-4-4 T-1 Class, 50 of which are now under construction. The present Q-2 is a larger and much more powerful freight engine than the Q-1, and has both sets of cylinders placed ahead of the wheels they drive. This simplified the rear crosshead guide construction and permitted a deeper firebox than was possible on the Q-1 locomotives, whose rear cylinders were placed at the front of the firebox.

The principal advantages of splitting the driving gear into two units are: (a) Reduction of piston loads and weight of revolving and reciprocating parts; (b) reduction in machine friction due to the reduced number of connected wheels; (c) the use of shorter stroke, resulting in lower piston speeds and (d) the use of four steam chests enables the designer to provide liberal steam and exhaust port areas. This improves cylinder performance at high speeds.

A distinctive feature of the Q-2 locomotive is a device for automatically arresting the slipping of either set of drivers and restoring the power to the slipping engine as soon as it has slowed down to the speed of the non-slipping engine. This is accomplished by means of butterfly valves located in each of the four main steam pipes. The operation of these valves is controlled by a differential electric switch which admits air to the butterfly valve operating cylinders of the slipping engine only. The differential switch is driven by small wheels running on the treads of one No. 2 and one No. 3 driver wheel. When the slip is arrested the air supply is shut off and the steam pressure in the steam pipes opens the butterfly valves to restore power.

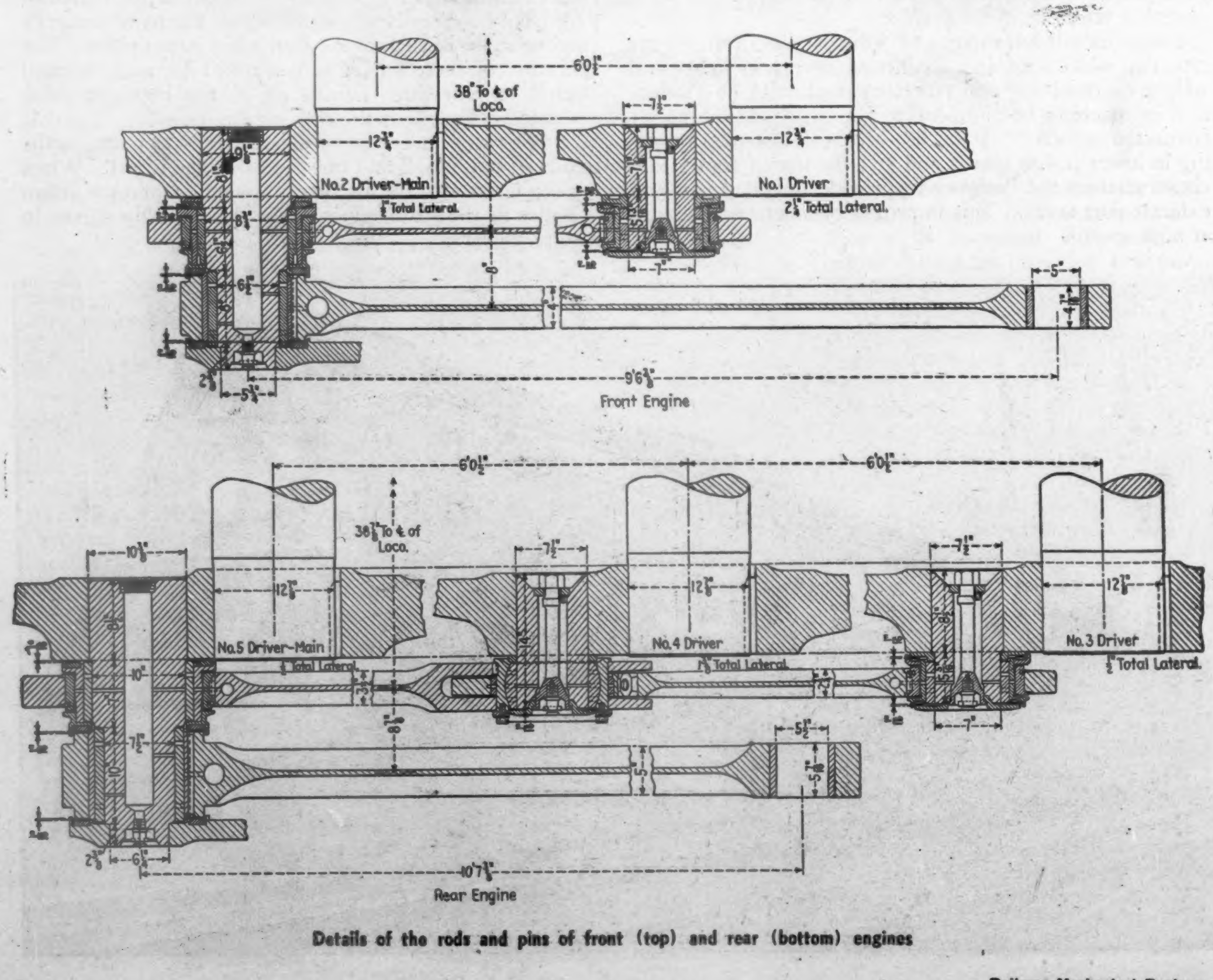
Q-2 locomotive No. 6175 has recently undergone a complete series of tests on the Altoona test plant, during which the estimated performance was exceeded. A maximum of 7,987 i.hp. was developed at 57.4 m.p.h. Maximum evaporation was 137,479 lb. of water per hour, or 39 per cent more than the Pennsylvania's Mountain Type M1a locomotive. The overall efficiency of the Q-2 locomotive measured at the drawbar was 25 per cent higher than the M1a locomotive, of which 12 per cent is credited to the four-cylinder driving gear arrangement and the balance to the boiler. At the highest boiler rate the smokebox gas temperature of the Q-2 locomotive was 655 deg. F. Coal consumption per drawbar horsepower hour varied from 2.75 lb. to 3.60 lb. between speeds of 49.2 and 50.6 m.p.h., depending upon the cut-off position.

The boiler of the Q-2 locomotive is of special interest because of its size and efficiency. It is one of the largest locomotive boilers ever built and showed a combined boiler and furnace efficiency under test of 49.8 per cent and when evaporating 137,479 lb. of water per hour and 64.4 per cent at a lesser rate. It has a firebox heating surface—including a 123 27/32-in. combustion chamber and a total of nine Security circulators—of 725 sq. ft. The tubes and flues add 6,000 sq. ft. more and the Type E single loop Elesco superheater 2,930 sq. ft. This makes a total evaporative and superheating surface of 9,655 sq. ft. With a grate area of 121.7 sq. ft. this boiler evaporated on the test plant 137,479 lb. of water per hour.

The boiler is the Belpaire firebox type with a three-course barrel utilizing carbon-silicon steel sheets 1 in. thick. The first course is conical and the maximum outside diameter, at the front of the combustion chamber, is 106 in. The firebox is 162 in. long and 108 3/16 in. wide. There are six circulators in the firebox and three in the combustion chamber. Near the rear of the combustion

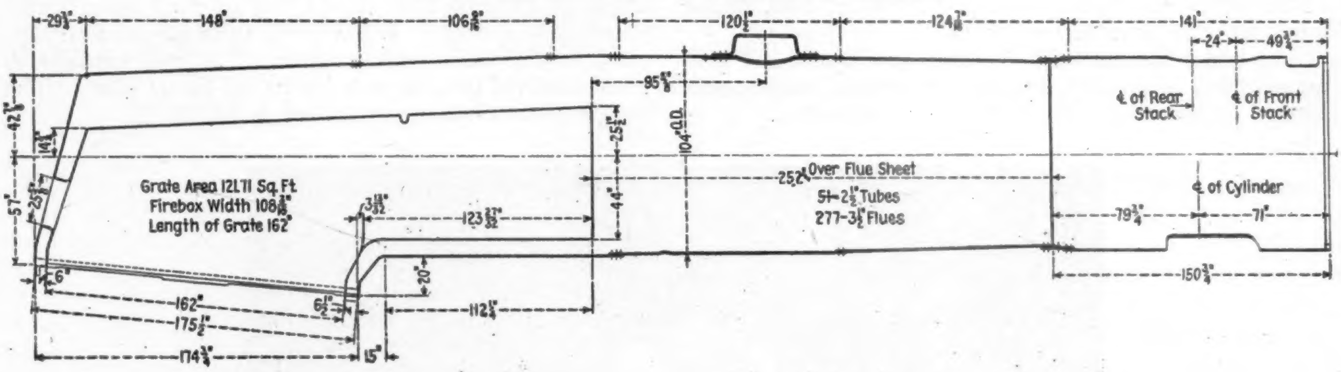
General Dimensions, Weights and Proportions

Builder	P. R. R. (Altoona)
Date built	1944-1945
Road class	Q2
Road numbers	6131, 6175-6199
Steam pressure, lb. per sq. in.	300
Drivers, diameter, in.	69
Cylinders, number, diameter and stroke, in.	19 3/4 x 28 front 23 3/4 x 29 rear
Rated tractive force, engine, lb.	100,800
Rated tractive force, booster, lb.	15,000
Valve gear, type	Walschaerts
Valves, piston, diameter, in.	12 front 14 rear
Maximum travel, in.	8
Steam lap, in.	1 11/16 front; 1 3/4 rear
Exhaust clearance, in.	1/8 front; 3/8 rear
Lead, in.	17/64 front; 1/4 rear
Cut-off in full gear, per cent	78 front; 75 rear
Dimensions:	
Height, rail to top of stack, ft.-in.	16—5 1/2
Height, rail to center of boiler, ft.-in.	10—10
Width overall, storm window open, ft.-in.	11—4
Length over engine and tender, ft.-in.	124—7 1/8
Cylinder centers, in.	92 front engine 95 1/2 rear engine
Wheelbases, ft.-in.:	
Driving	26—4 1/2
Rigid	20—4
Engine, total	53—5 1/2
Engine and tender, total	107—7 1/2
Weights, lb.:	
Front truck	96,050
Drivers	393,000
Trailer truck	130,050
Engine, total	619,100
Tender, (loaded)	430,000
Weight on drivers per cent weight of engine	63.5
Weight on drivers ÷ tractive force	3.90
Tender:	
Style or type	Rectangular
Water capacity, U. S. gal.	19,020
Fuel capacity, tons	39.87
Trucks	Eight-wheel



Details of the rods and pins of front (top) and rear (bottom) engines

General Dimensions and Proportions of the Boiler



Tubes, number and diameter, in.	51—2¼
Flues, number and diameter, in.	277—3½
Length over tube sheets, ft.-in.	21—0
Net gas area through tubes and flues, sq.-ft.	13.02
Superheater, Type	E, single loop
Fuel	Bituminous
Grate area, sq. ft.	121.7
Stoker, Type	Standard HT
Feedwater heater, Type	Worthington 6½ SA
Heating surfaces, sq. ft.:	
Firebox, circulators and combustion chamber	725
Firebox, total	725
Tubes and flues	6,000
Evaporative, total	6,725
Superheater	2,930
Combined evap. and superheat.	9,655
Boiler proportions:	
Firebox heat. surf., per cent comb. heat. surf.	7.5
Tube-flue heat. surf., per cent comb. heat. surf.	62.1
Superheat surf., per cent comb. heat. surf.	30.3
Firebox heat. surf. ÷ grate area	5.9
Tube-flue heat. surf. ÷ grate area	49.3
Evap. heat. surf. ÷ grate area	55.2
Superheat. surf. ÷ grate area	24.0
Comb. heat. surf. ÷ grate area	79.3
Gas area ÷ grate area	.107
Tractive force ÷ grate area	828.2
Weight of engine ÷ evap. heat. surf.	92.0
Weight of engine ÷ comb. heat. surf.	64.1
Tractive force ÷ evap. heat. surf.	15.0
Tractive force ÷ comb. heat. surf.	10.4
Tractive force × diameter drivers ÷ comb. heat. surf.	720.4
Steam pressure, lb.	300
Diameter, first course	Conical
Diameter, first course, outside, in. (front)	97 15/16
Diameter, second course, inside, in.	102
Diameter, second course, outside, in.	104
Diameter, third course, inside, in.	104
Diameter, third course, outside, in.	106
Sheet thickness, in.:	
Smokebox	⅝
First ring	1
Second ring	1
Third ring	1
Back head	½
Roof and side sheet (one piece)	½
Furnace door sheet	13/32
Furnace side sheets	13/32
Furnace crown sheet	13/32
Combustion sheet	13/32
Front tube sheet	¾
Back tube sheet	9/16
Firebox length, in.	162
Firebox width, in.	108 3/16
Water space, front, in.	6½
Water space, back, in.	6
Water space, sides, in.	6
Combustion chamber length, in.	123 27/32
Arch tubes, number and diameter, in.	None
Circulators number and location	Six in firebox Three in combustion chamber

chamber there is a corrugation in the sheet around approximately three-quarters of the combustion chamber circumference to allow for lengthwise expansion and contraction. The firebox has an installation of Flannery flexible staybolts in the breaking zones, back head, throat sheet and combustion chamber. The furnace sheets are welded and the firebox and barrel seams are seal welded.

Water is fed to the boiler by a Worthington 6½ SA feedwater heater having a capacity of 120,000 lb. per hr. and a Sellers SY injector, on the left side, with 132,000 lb. capacity per hr. The injector delivery pipe is located inside the boiler and admits water at a point about 30 in. back of the front flue sheet, above the flues. The firebox is equipped with Firebar grates, Standard HT stoker and Franklin Butterfly type firedoor.

The engine bed, supplied by the General Steel Castings Corporation, embodies the frames, crossties, cylinders and back heads. The connection of the cylinders to the bed, between the No. 2 and 3 drivers, is necked in such a manner that the distance normally between these drivers is reduced, permitting the total wheelbase to be shortened approximately 15 in. The distance between cylinder centers at the front engine is 92 in., while for the rear engine it is 95½ in.

The engine and trailer trucks are each four-wheel trucks, with 36-in. wheels on the front truck and 44-in. on the trailer. The trailer is equipped with the Franklin Type E booster. All driving, engine and trailer truck, and tender axles are equipped with Timken bearings.

The four-wheel engine truck is equalized with the drivers of the front engine and the rear engine drivers are equalized with the trailer truck. Helical springs, in combination with leaf springs, operate to increase the sensitivity of the equalization system and to cushion the shocks of the leaf springs.

The cylinders of the front engine are 19¾ in. by 28 in. and the rear engine, 23¾ in. by 29 in. Steam distribution is effected by 12-in. and 14-in. piston valves for the front and rear engines, respectively, together with Walschaerts valve gear controlled by Alco power reverse gear.

The drivers are 69 in. diameter with Boxpok centers. The rear drivers of each engine, No. 2 and No. 5, are the main drivers. Each of these has ½ in. total lateral. The No. 1 wheel of the front engine has 2¼ in. total lateral and the front wheel of the rear engine, No. 3 wheel, has ½ in. total lateral. This wheel, however, is equipped with a blind tire. The No. 4 driver has 1⅜ in. total lateral. The Alco lateral motion device is used on all driving axles.

The rods are the I section design equipped with floating bushings at all pins. A spherical bushing is used at No. 4 wheel and the side rod bearings for No. 1, 2, 3 and 5 wheels have a radius on the outer bushing to accommodate operation on curves. The main crank pins have the conventional floating type bushings.

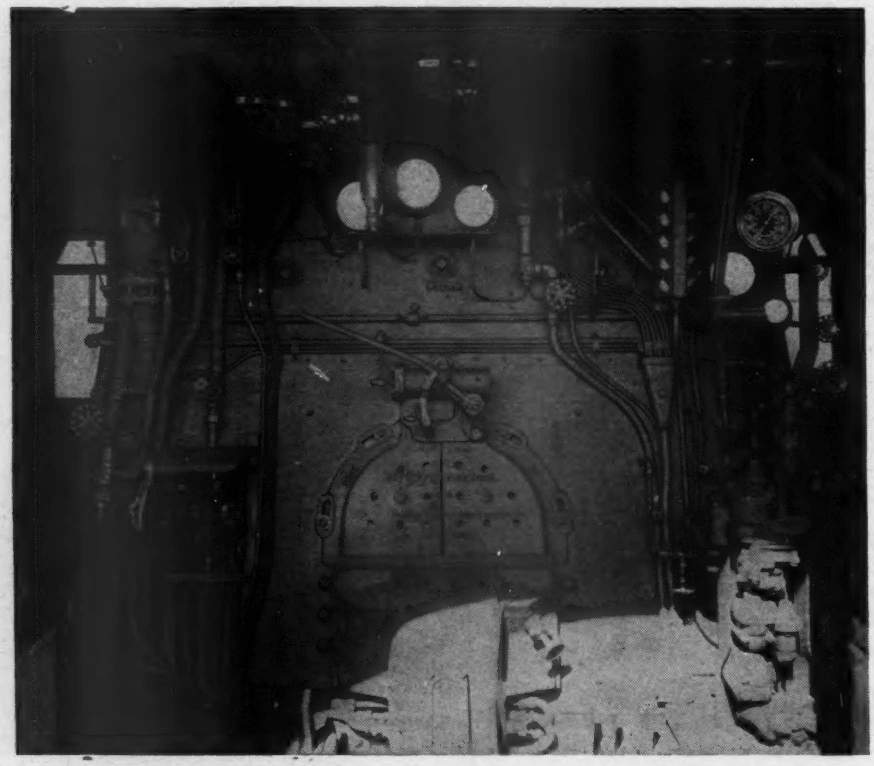
The main wheels of the Q-2 are cross counterbalanced with an overbalance of 100 lb. The resultant overbalance producing dynamic augment on No. 4 wheel is 150 lb. delivered at 22 deg. from a line through the main pin and axle and, on No. 1 and 3 wheel this resultant is 160 lb. at 14 deg. The dynamic augment on No. 1 and 3 is 7,670 lb. at 70 m.p.h.

The locomotive is equipped with three Detroit mechanical lubricators, two on the right side and one on the left side. Pressure lubrication from these lubricators is dis-

tributed to cylinders and valves, frame shoes, boiler pads, radial buffer, spring rigging frame equalizer pins, engine truck center pin and to the guides.

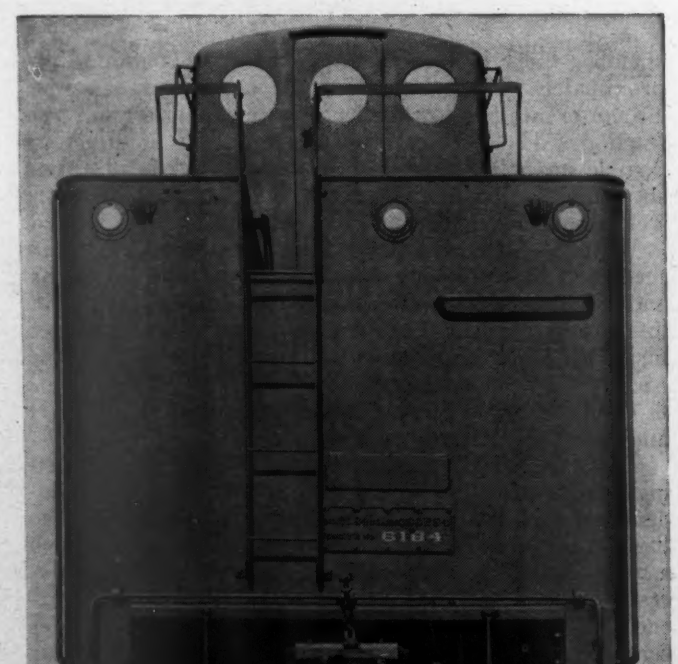
The brake equipment is Westinghouse No. 8 ET with air supplied by two 8½-in. cross compound compressors located on brackets at the front of the locomotive.

The tender is of the rectangular type with eight-wheel trucks of Pennsylvania design cast by the General Steel Castings Corporation and water bottom underframe supplied by the same manufacturer. The coal capacity is 39.87 tons and the cistern holds 19,020 gal. of water. The weight of the tender, fully loaded, is 430,000 lb.



Partial List of Material and Equipment on the Pennsylvania 4-4-6-4 Type Locomotives

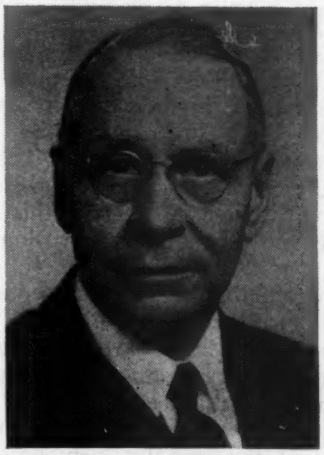
Bed frame; engine and trailer truck frames; driving wheel centers	General Steel Castings Corp., Eddystone, Pa.
Lateral motion device; power reverse gear	American Locomotive Co., New York.
Engine truck, driving and trailer truck roller bearings	The Timken Roller Bearing Co., Canton; Ohio.
Radial buffer; booster; fire door	Franklin Railway Supply Co., Inc., New York.
Air brake equipment	Westinghouse Air Brake Co. Wilmerding, Pa.
Brake shoes	American Brake Shoe Company, New York.
Slip control	Pennsylvania Railroad. American Brake Shoe Company, New York.
Mechanical lubricators	Detroit Lubricator Co., Detroit, Mich.
Grease fittings; clear vision windows; cab ventilators	The Prime Manufacturing Co., Milwaukee, Wis.
Piston packing rings	American Hammered Piston Ring Division of Koppers Company, Baltimore, Md.
Flexible staybolts	Flannery Bolt Co., Bridgeville, Pa.
Feedwater heater	Worthington Pump and Machinery Corp., Harrison, N. J.
Injector	Wm. Sellers & Co., Inc., Philadelphia, Pa.
Boiler check valve	Nathan Manufacturing Co., New York.
Circulators	American Arch Co., New York.
Firebar grates	Waugh Equipment Co., New York.
Blow-off cocks; blower valve	The Okadee Company, Chicago.
Throttle valve	American Throttle Co., New York.
Stoker	Standard Stoker Co., Inc., New York.
Superheater	The Superheater Company, New York.
Lagging	Johns-Manville Sales Corp., New York.
Headlight generator	The Pyle-National Company, Chicago.
Train control	Union Switch & Signal Co., Swissvale, Pa.
Tender:	
Truck frames; tender frame; tank bottom	General Steel Castings Corp., Eddystone, Pa.
Roller bearings	The Timken Roller Bearing Co., Canton, Ohio.
Draft gear	Cardwell Westinghouse Co., Chicago.
Couplers	McConway & Torley Co., Pittsburgh, Pa.



The rear of the tender

Passenger Cars – 1946 Models*

By Allen W. Clarke†



Allen W. Clarke

An evaluation of the factors influencing 1946 car design such as specifications, materials, passenger comfort, and trends toward standardization

THE background for the 1946 models begins with the advent of the modern lightweight streamlined passenger cars in 1934 and 1935. Some of these first trains have become obsolete and have been scrapped because of small dimensions or for other reasons. Others are still in satisfactory and profitable operation. In the early designs great emphasis was placed on the reduction of wind resistance. To obtain this reduction the width and height of cross section was decreased over conventional cars, greatly restricting the useful space for passengers. Wind tunnel tests have demonstrated the relative unimportance of cross section dimensions to wind resistance. In 1940 the Association of American Railroads adopted a standard cross section contour, 10 ft. wide over side posts and 13 ft. 6 in. from rail to top of roof. These dimensions will prevail in the 1946 models. The A. A. R. cross section provides for a curved skirt extending to 22 in. from the rail. The skirt adds to the streamline appearance but permits accumulations of dirt, snow, and ice and adds to the difficulties of maintenance men working on equipment mounted under the car. Some of the 1946 models will have the skirts but considerable numbers will appear either without skirts or with the "hemline" considerably higher than the 22 in. A. A. R. dimension from the rail.

Design Factors

Minimum structural strength requirements for new passenger train cars were established by the A. A. R. specification of March 24, 1939.

The A. A. R. specification of 1939 was based on the Railway Mail Service specification of 1912 to which minor revisions had been made, the last revision being made on July 20, 1938. Changes included the provision for the use of new materials and alloys, added squeeze test requirements, and specified shear value of the main end posts.

As a result of injury to passengers and damage to equipment under some very unusual wreck conditions there have arisen requirements by some railroads considerably exceeding those of the A. A. R. specification. Such increases in strength requirements will result in weight increases of 5,000 or more pounds per car. The builders can design for any specified assumed or test loads but in so doing must add to the weight and cost regardless of the material used.

As a matter of fact the A. A. R. minimum figures have been exceeded by most of the designs built in the past and this will hold true for the 1946 models. Also, strength calculations are usually based on the framing members only and do not take into account the value of inside finish, partitions, and accessories. Figures for a recent design offered for 1946 production indicate the following percentages in excess of the A. A. R. minima:

Center sills, per cent	33
Main end posts—shear, per cent	24
Main end posts—bending, per cent	15
All vertical end posts, per cent	7

The economies resulting from light weight are of such importance that the majority of the new cars will probably be designed to the A. A. R. specification as a minimum with additional strength, as indicated above, resulting from the use of available standard sections. Materials always exceed the minimum properties used in calculations and increase the actual strength of the structure.

The stress analysis for passenger-car framing members is readily made by the use of well known and generally accepted formulae with the possible exception of the center sill. Here the problem becomes complicated because it is a continuous beam supported by several cross members of varying stiffness and subjected to vertical loads as well as longitudinal end loads from buffing forces. Direct compression stress from end loads is obtained from the P/A formula where P equals the design or test end load and A equals the center sill area. This stress varies throughout the full length of the sill only as changes in center-sill area may be included in the design and as compressive forces are transferred to the side sills by the cross members.

As buffing forces must be considered as applied at the center line of draft, at the nose of the end casting, and on a resultant line between these two, the bending moments resulting from these various eccentricities must be considered along with the bending moments resulting from the vertical loads. The center sill cannot be considered as a continuous beam with fixed supports because of the flexibility of the sill itself and the cross members which

*Abstract of paper presented before the Railroad Division, the American Society of Mechanical Engineers, at the Annual Meeting at New York on November 29, 1945. An abstract of the written and oral discussion of this paper will appear in the February, 1946, issue.

† Assistant general mechanical engineer, American Car and Foundry Company, St. Charles, Mo.

transfer the reactions to the sides and other parts of the structure. Very approximate determinations for center sill moments have been made which are considered close enough for practical purposes and have resulted in the following formulae for an 85-ft. coach with a vestibule at one end, 59 ft. 6 in. bolster centers and five equally-spaced crossbearers between bolsters. Signs are indicated for the end load P applied below the neutral axis of the center sill.

Body end	$-M = -466\,w + .0041\,Pe$
Face of rear draft lug	$M = 1224\,w + .4462\,Pe$ $-M = 1224\,w - .5578\,Pe$
Bolster	$M = -1022\,w + .1319\,Pe$
Crossbearer No. 1	$-M = -1223\,w - .0356\,Pe$
Crossbearer No. 2	$M = -1166\,w + .0104\,Pe$
Crossbearer No. 3	$-M = -1192\,w - .0061\,Pe$
Crossbearer No. 4	$M = -1146\,w + .0139\,Pe$
Crossbearer No. 5	$-M = -1304\,w - .0497\,Pe$
Bolster	$M = -713\,w + .1847\,Pe$
Face of rear draft lug	$M = 1803\,w + .6793\,Pe$ $-M = 1803\,w - .3209\,Pe$

Where

M = Bending moment
w = Vertical load per inch in pounds
P = Horizontal end buffing load
e = Eccentricity of horizontal end load

It is recognized that the above figures are not absolutely accurate as the flexibility of all supporting members, which contribute to the stiffness of underframe members, has not been considered. However, these are sufficiently accurate for practical purposes because the moments between the end of the car and the first crossbeam back of the bolster control the design.

Center-sill area properly distributed in the cross section is of major importance. Area of course directly controls the compressive stress due to the end load and is of greater importance in connection with bending moment stresses. Deflections control the distribution of stresses in the structure, hence the modulus of elasticity of the material and the moment of inertia (a function of area) of the center-sill section become a factor of greater importance than the tensile strength of the material used.

Materials

No new basic structural materials are likely to be used in the 1946 passenger cars. The materials used before the war and which will continue to be used are (1) mild carbon steel, copper bearing; (2) low-alloy high-tensile steels; (3) stainless steels, and (4) aluminum alloys.

However, new alloys with improved properties are now available especially in the low-alloy high-tensile steels and aluminum. All of the above basic materials have been used in modern lightweight passenger cars and have proven satisfactory in squeeze tests and in service.

Designs employing all of these materials may be expected to meet and exceed the minimum requirements of the A.A.R. specification, hence, this does not enter into the selection. Other factors which must be considered are weight, cost, and appearance.

As the total weight of the material in the structural shell is only from 25 to 35 per cent of the total weight of the completed car, the percentage of total weight which can be saved by the use of light high-strength materials and careful design is somewhat limited. For example, the total truck weight will usually equal or slightly exceed the weight of a low-alloy high-tensile steel shell. This indicates the necessity for a thorough study of weights of specialties, finish materials, and accessories as a fertile field for weight reduction.

Of the four basic materials mentioned above mild carbon steel will produce the heaviest car, other factors being equal. Considering a coach 85 ft. long over the coupler pulling faces, with four-wheel trucks and other features the same, the use of low-alloy high-tensile steel or stainless steel with equal strength values will show a weight saving of 6 to 8 per cent of the total car weight over mild carbon steel and the use of aluminum will show about a 15 per cent saving.

Lowest costs favor the use of mild carbon steel but with the weight penalty as mentioned above. The cost of low-alloy high-tensile steel construction is less than for stainless steel construction with little if any difference in weight when designs are of equal strength.

Hence, the former is indicated to be the preferred material for economic reasons. The service life of mild carbon steel is longer than the period between construction and obsolescence and there should be no question about low-alloy high-tensile steels in this respect because they have greater resistance to corrosion than the mild carbon steels.

The cost of aluminum has been reduced steadily as production has increased. In the last five years the price of pig aluminum has been lowered about 25 per cent. Hence, the cost penalty against the use of aluminum is now considerably less than before the war. A large number of the new cars will use the aluminum alloys for a major portion of the framing members as well as for inside finish and fittings. When minimum weight is of vital importance due to power limitations, or other factors, aluminum alloys will be the preferred structural material.

Exterior Appearance

In exterior appearance the 1946 models will be of three types, either shiny unpainted, painted, or a combination of shiny and painted.

Stainless steel in fluted sections is well adapted to the shiny unpainted exterior and may be applied either on framing of low-alloy high-tensile steel or stainless steel. The surface of stainless steel however is not well adapted to the application of paint coatings. A similar shiny unpainted fluted appearance will be accomplished on a number of the cars of aluminum construction by the use of extruded anodized aluminum mouldings.

For painted exteriors, low-alloy high-tensile steel and aluminum construction are best adapted. With the spot-welded attachment of side sheets the low-alloy high-tensile steel sides will be perfectly smooth without exposed rivet heads or other projections, which makes cleaning easy and accumulates a minimum of dirt enroute.

The painted exterior or the combination of painted surfaces with unpainted fluted surfaces have the advantage of making possible distinctive color schemes for individual railroads. When tied in with an advertising program this color scheme will soon become a symbol of the particular railroad in the public mind.

Passenger Comfort

The equipment now on order for 1946 production includes passenger train cars of many types such as baggage, baggage and mail, baggage-coach, baggage-dormitory, diner, diner-lounge, observation-parlor and coaches. Of the cars scheduled, not including sleepers, coaches considerably outnumber cars of other types.

This probably represents a trend on the part of the railroads to exert their best efforts to attract the coach passenger and a recognition of this class of travel as the best field for the profitable movement of large numbers of people. It is in this field that the railroads have their greatest advantage over other forms of transportation; namely, the comfort which comes from adequate space, giving the passenger freedom to move about and at the

(Continued on page 12)

JUST KNOCKING ALONG

by Walt Wyre

WHEN the electricians on the S. P. & W. took over maintenance of refrigeration equipment, they inherited a sizable portion of grief along with it. While there is not a lot of the equipment, just that used at the railroad eating houses and a few water coolers, most of it is getting along in years and was about ready for retirement when the war froze the equipment on the job.

Ned Sparks, the electrician at Plainville, has his share of trouble and maybe a little more taking care of the refrigeration equipment in the beaneries at Plainville, Middleton, and Sanford, along with about two dozen water coolers scattered over the Plains division.

Sparks was already more than slightly peeved when he received word that the refrigerating machinery for the big walk-in cooler in the beanery at Sanford wasn't working. The electrician had stuck his neck out by offering to repair an electrically operated calculating machine used in the freight office. The motor that operated the machine wouldn't run and Sparks figured the brushes were worn out and perhaps the commutator a little dirty. Both guesses were correct, but he hadn't figured on the armature being burned out also.

A search of every possible place for an armature in Plainville, and wires to half a dozen other towns and a phone call to the system storekeeper, failed to locate a new armature, and no one would promise to rewind the one burned out any time soon. The result was Sparks undertook to wind the armature. He was about half finished with the job when Jim Evans, the roundhouse foreman, came in. Sparks had just lost count of the turns, along with most of his patience, when Evans entered.

"Something wrong with the refrigeration in the eating house at Sanford," Evans said. "You had better catch the Limited and get up there," the foreman added.

"Dammit!" Sparks snapped, "now I'll have to unwind this coil and start over!"

"What's that you are working on?" Evans asked. "We haven't got any motors around here that small, have we?"

"It's out of a calculating machine used in the freight office," Sparks told him. "Them nitwits didn't go to school the same day the teacher did and have to have a machine to handle figures. They can't count on their fingers."

"Finish it when you get back from Sanford," Evans told Sparks. "I have an idea a new belt is about all it needs."

"Yeah, I imagine it needs a new belt and a new machine to go with it," Sparks said as he gathered up parts of the motor and placed them in a box.

SPARKS arrived at Sanford about four-thirty that afternoon. Figuring to go back to Plainville on the Limited, leaving Sanford at 9:45, he didn't make arrangements for a room but went directly to the eating house.

Paul Drake, the manager, was waiting when Sparks went in the dining room. "Boy, am I glad to see you!" Drake said. "I've got the box full of meat and I'm afraid it's going to spoil."

"Is the refrigerator working at all?" Sparks asked.

"Yes," Drake told him, "it's running, but not doing much good. The motor starts and stops every few minutes and the box is not as cold as it should be."

"I'll look at it soon as I get a bite to eat," Sparks said. "The diner was so crowded I couldn't get in."

After Sparks had eaten he carried his tool box to the basement where the refrigerating machine was located. The first thing he did was put gauges on the high and low pressure sides of the compressor. Both gauges showed too much pressure when the compressor was running.

"Found the trouble?"

Sparks looked up and saw Drake, who had come down to see how the electrician was getting along. "Some of the trouble, at least," Sparks told him. "The high head pressure indicates air in the system, but that's not what's making it short cycle."

Sparks stopped the motor and left the switch open so it wouldn't start. He then back seated the discharge service valve and removed the gauge. While he was doing that, Sparks glanced at the low pressure gauge and saw that the pressure on the low side was rising rapidly. When the pressure reached sixty pounds, Sparks grabbed his service valve wrench and back seated the valve to shut the pressure off from the gauge and prevent possible damage.

"That's why the machine is short cycling." Sparks pointed to the gauge.

"Short cycling?" Drake asked. "Is that good or bad?"

"Starts and stops so often," Sparks explained, "acts like either the float valve was leaking or else the compressor discharge valve."

"Is that much of a job?" Drake asked anxiously.

"Could be quite a job," Sparks told him. "Soon as the machine has stood ten or fifteen minutes so I can bleed the air out, I'll check and see which valve is letting the high pressure get back to the low pressure side."

The eating house manager began to get fidgety while Sparks was waiting for the compressor to stand idle so the air could be bled off, and Sparks said, "guess I'll run upstairs and take on a cup of coffee while I'm waiting."

SPARKS drank the coffee and returned to the basement. He cracked the discharge service and left it barely open about ten seconds, closed the valve and waited a few minutes, then opened it again for a few seconds. He then replaced the high pressure gauge and started the machine. "Wish you would go see if there is any frost forming on the evaporator," he said to Drake.

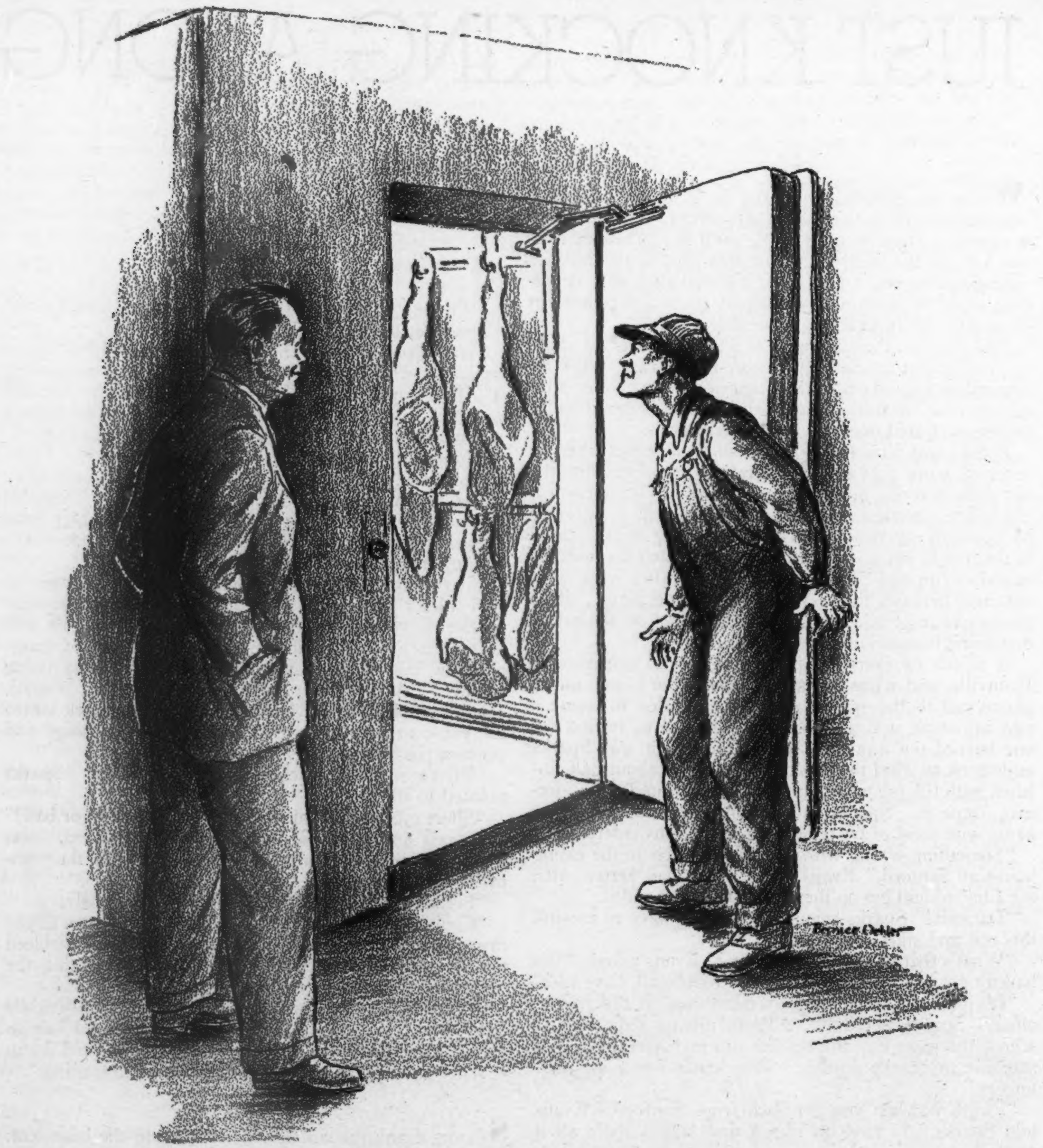
"The evaporator—where is it?" the manager asked, perplexed.

"The cooling unit—in the refrigerator," Sparks explained.

"Yes, it's working better," Drake said when he had returned. "Maybe that's all it needed," he added hopefully.

"Don't think so," Sparks told him. At that instant the machine shut off. "It stopped sooner than I figured it would," Sparks said as he watched the gauges.

The low side gauge showed rapidly increasing pressure as soon as the compressor stopped, and in about thirty seconds the machine started again. Sparks picked up a



"Looking at my tapper?" the manager asked

ten-inch Crescent wrench and a service valve wrench and went upstairs to the cooler. He removed the service valve caps at the evaporator and when the machine shut off closed both valves, the ones to the liquid line and the suction line. When the valves were closed, Sparks started down stairs. Before he had reached the basement, the machine started again.

"Now what?" the manager wanted to know.

"Looks like the compressor discharge valves are leaking," Sparks told him.

Sparks closed both service valves on the compressor and started removing the head. He loosened the cap screws, then working very carefully to avoid damaging the gaskets he removed the head and valve plate.

"No wonder the valves are leaking!" Sparks exclaimed. "Look how they are worn and the carbon."

Sparks intended to turn the valves over, but inspection showed that both sides of the valves had been used already. A phone call to the one and only refrigerator service shop in Sanford produced a disinterested reply that he had no valves and probably wouldn't have any for four or five weeks.

"What'll you do?" Drake was getting anxious.

"If I can find a small piece of plate glass, I'll use some fine valve grinding compound and try my hand at lapping the valves."

A piece of plate glass was found and Sparks set to work.

Drake watched the procedure about fifteen or twenty minutes, then said, "Guess I'd better go help with the supper rush. I should have been up there 30 min. ago."

"Gosh, what time is it?" Sparks asked.

"It's after six," Drake said after he had looked at his watch.

"Guess I had better call the hotel and see about a room," Sparks laid down his tools and wiped his hands on a rag.

There was no room available at either of the two hotels. "Guess I'll have to work fast and eat in a hurry," Sparks told the manager. "Soon as the rush is over, have the cook fix me something to eat. Let me know when it's ready."

Sparks went back to the basement and again started working on the valves. When the valves were lapped until they appeared good, Sparks cleaned the carbon from the compressor pistons and head, then washed the parts with carbon tetrachloride to remove any particles of grit and moisture. At that moment Drake called and told him his supper was ready.

Sparks ate hurriedly and went back to the job. At 8:25 he had the compressor ready to run again. He closed the switch and went to the refrigerator to see if it was cooling okay. The gurgle of liquid and frost beginning to form almost immediately on the evaporator were good signs.

After the machine had run about twenty minutes, Sparks stopped it and again purged the air from the system. This was necessary because he knew some air had gotten in when he had dismantled the compressor and some remained even after he had pumped the air from the compressor before opening the discharge service valve to the liquid line.

The machine was still running when the Limited pulled in town and the box was cooling nicely. It had become so warm while shut down that it would probably run two or three hours before shutting off, Sparks told the eating house manager.

NEXT morning when Sparks reported for work at the roundhouse, the foreman told him that the freight agent had phoned twice and the chief clerk to the superintendent once wanting to know when the motor for the calculating machine would be finished.

"I can get it done today if I don't have too much else to do," Sparks told Evans.

"Well, the first thing I want you to do is see what's ailing the overhead crane. Then when you get that fixed you can get on the motor."

"What seems to be the trouble with the crane?" Sparks asked.

"It won't go up," Evans explained. "It'll run down okay, at least it would until machinist Thomas worked on it. You know, he claims to be sort of an electrician. I think he worked for a power company awhile. He changed some wires or something, then the crane would go up and wouldn't come down. All of the controls worked right opposite the way they always have."

"Okay," Sparks said. "I'll get it first thing."

When the starting whistle blew, Sparks pocketed some tools and went to the machine shop. The first thing he did was switch two of the three phase lines to the crane. Then he pulled the main switch and climbed up to look at the limit switch that prevented the hoist going up too far. One of the wires to the limit switch was broken off right where it connected to a terminal post on the switch. The wire was long enough to replace without splicing and it was only a matter of minutes to remove the insulation and replace the wire on the terminal.

That fixed, Sparks went back to the electric shop and prepared to start work where he had left on the little armature. He had the armature set up ready to start winding when Evans came in the electric shop.

"Got the crane fixed?" Evans asked.

"Yes, sir," Sparks replied.

"Well, you had better take a look at the electric welder by the drop pit," Evans said. "Barton is welding a cracked dry pipe and he says it's not working very well. He says it acts like the polarity is reversed."

Sparks swore mildly, picked up some tools, and headed for the roundhouse. He stopped the motor that ran the welder, then threw the polarity switch. After waiting a few moments, he started the machine, then climbed up into the locomotive cab.

Barton had his head stuck out of the firebox door when Sparks climbed up in the cab. "Did you stop the welder?" Barton asked.

"Yes," Sparks told him. "Try it and see how it works now."

The boilermaker went back and ran an electrode in the weld. "It works okay," he yelled to Sparks. "What did you find wrong with it?"

"Polarity reversed," Sparks said. "Next time you might look at the switch."

Barton grunted and went back to welding. Sparks returned to the electric shop.

That time he wound one coil of the armature and was starting on another when the foreman again came to the electric shop. "The manager of the eating house at Sanford just phoned. Said you fixed the refrigerator too good, it ran all night, froze everything in the box, and would be still running if he hadn't pulled the switch. You'll just about have time to catch the Limited if you hurry."

As before, the manager of the eating house met Sparks at the door. "First it won't cool enough, then it cools too much, and now it won't cool at all."

"What did you do to it?" Sparks asked.

"Well, this morning everything was frozen and it was still running. I pulled the switch and called you. Then about an hour later I closed the switch. The compressor runs all right, been running ever since I closed the switch, but it doesn't seem to be cooling."

Sparks took his tool box and went to the basement. A quick inspection showed why the motor had failed to shut off. A pin had come out of the switch lever. He replaced the pin, then went to look at the evaporator.

"See, it's so hot it's sweating." Drake had followed Sparks to the box.

Sparks held his ear close to the float unit header and listened. There was no gurgle or hiss indicating that the float valve was stuck or a screen clogged. Sparks tapped the float unit header with a pair of pliers and the liquid refrigerant began to gurgle into the evaporator. A few minutes later frost began to appear on the evaporator.

Once again that evening before the train came in, the float valve stuck shut and came open when Sparks tapped it.

"Do you think it will stick any more?" the manager wanted to know.

"Can't tell," Sparks replied. "If it keeps sticking, we'll have to take the float unit out and see what's causing it to stick."

"Is that much of a job?" Drake asked.

"Pretty good sized job. The first thing, we will have to pump all the refrigerant out of the evaporator into the receiver, then when we remove the unit we should have a new or repaired one ready to put in. Of course, opening the evaporator will get quite a bit of air in the system that will have to be purged out."

"Well, let's try it awhile," Drake suggested, "and in the meantime maybe it would be a good idea for you to order a new float unit, or whatever you call it."

"Okay," Sparks said, "I'll have the storekeeper order a float unit tomorrow."

NEXT morning at Plainville, it was the same old story. The freight agent, chief clerk to the superintendent and half a dozen others had called wanting to know when the motor would be finished for the calculating machine.

"Don't do anything else until you finish that blasted little motor," Evans told Sparks, "unless something else very important needs to be done," he added.

Sparks worked almost an hour on the armature and only lacked two coils having the winding ready for soldering when the drop pit motor quit.

Water had seeped into the conduit to the switch causing a short. The resulting arc had welded the wires to the conduit. It was necessary to dig the conduit out and replace it. It was less than an hour to quitting time that afternoon when the job was finished and Sparks went back to the armature.

By working thirty minutes after quitting time, Sparks finished the armature and dipped it in varnish. He improvised a bake oven using an electric lamp.

NEXT morning Sparks assembled the motor and carried it to the freight house.

Every one in the freight house stood and watched while Sparks put the motor in the calculating machine. When it was in place, he plugged it in and a clerk started punching keys while Sparks watched the motor. It whirred, then stopped. Sparks pulled the plug and tried to see if the machine was stuck. The motor shaft turned easily enough in one direction, but refused to turn the opposite way.

"Plug it while I watch the motor," Sparks told the clerk.

The motor acted the same as before. "See anything wrong?" the freight agent asked.

"Yes," Sparks replied. "Looks to me like the motor is running backwards."

"Can't you switch the wires and reverse it?" the clerk asked.

"No," Sparks told him. "I'm afraid I'll have to take it out."

"What makes it run backwards?" the agent asked.

"Well, if it is running backwards, as it looks to be, it's because I changed the commutator pitch when I connected the wires," Sparks told him.

"What'll you have to do, pitch it again?" the clerk wanted to know.

"No, I can change the connections to the fields," Sparks told him.

"Well, get it soon as you can," the agent said. "We sure need the machine."

Sparks took the motor and started back to the roundhouse.

The field coil leads were too short to reach when reversed and it was necessary to splice them. It was noon when he made the agent happy by announcing that the calculating machine was okay.

Things went along about normally for the next four or five days. Sparks was beginning to congratulate himself on having gotten rid of the refrigerator at Sanford for good, when the eating house manager phoned.

"Have you got the new what-you-may-call-it for the cooler you ordered?" the manager asked.

"No," Sparks replied, "it hasn't come yet. Why, are you having trouble with the refrigerator?"

"Yes," the manager said, "but I guess we can get along until you get the parts. Soon as it comes, you'd better run up here and put it in."

Sparks went to the storeroom and asked the storekeeper if he had anything on the float unit for the refrigerator at Sanford.

"No, haven't heard anything since I wired for it. I'll send another wire today and urge it," the storekeeper promised.

Two days later the float unit came in. Sparks told the foreman that it might be a good idea to go to Sanford the next day and put it in.

"Looks like," Evans remarked, "either you are going to have to move to Sanford or else bring that refrigerator here."

The eating house manager was not in when Sparks arrived. Sparks took his tool box and went to the basement. The machine was idle at the moment and Sparks installed his gauges preparatory to pumping the refrigerant from the evaporator.

While he was tightening the connection to the compound gauge on the suction service valve, the motor started. It seemed to be running okay, except there was a peculiar dull rattle. Sparks stopped the motor, looked for something loose that might be causing the rattle, but didn't find anything. When he closed the switch, the rattle started again. It seemed to be coming from the copper tubes leading from the condensing unit to the refrigerator.

Sparks stopped and started the motor twice, the rattle stopped and started also. The electrician was fairly well puzzled. The noise was different from any he had ever heard around a refrigerating unit before. Finally he decided to go ahead, rattle or not, and pump the refrigerant into the receiver and install the new float unit.

Sparks closed the receiver service valve and with gauges mounted on the compressor service valves started the motor. He then went upstairs to open the refrigerator so the evaporator would warm up and facilitate discharge of the refrigerant.

When he opened the refrigerator door, he found the rattle. A large electric gong with the bell removed was mounted so the clapper struck the float unit header. It was clattering away when Sparks opened the door.

He stood looking with amazement at the Rube Goldberg contrivance wondering what it was all about when the eating house manager came in.

"Looking at my tapper?" the manager asked.

"Yes," Sparks replied, then the reason for the arrangement dawned upon him.

"That dingus kept sticking," the manager said, "and I rigged up that outfit. It's a little noisy, but it works. What do you think of it?"

"Well, it's ingenious," Sparks commented. "Maybe you won't need it when I get the new unit in."

Radio Rules Formally Adopted.—The Federal Communications Commission has announced the formal adoption of rules and regulations to govern railroad radio service, effective December 31, in the same form as the proposed rules issued in November, with one exception. Upon request of the Association of American Railroads, the final form of the rules omits the provision which would have authorized communications common carriers (that is, telephone, telegraph or similar companies) to be issued experimental authorizations for railroad radio service stations. This authority can be issued under other regulations. The A. A. R. also had objected to the provision limiting the license term for railroad radio stations to two years, asking that a 5-year term be substituted, but the commission refused to extend the term beyond two years "at this time" on the ground that it is customary to have a shorter license term for the initial period so there can be "flexibility in making any necessary revisions in frequency assignments."

Conservation of

Coal for Locomotives*

By J. F. Barkley†

THIS year the demand for locomotive service is at a peak. High tonnages of coal must be burned. Coal is not easy to obtain, and much that is obtainable is of lower grade than was formerly used. Nevertheless, trains are being moved in a manner that has resulted in the general impression throughout the country that "the railroads are doing a good job". The locomotive men's ability to meet the needs in this way is without question rooted in their many years of work on fuel efficiency discussed and encouraged at meetings of this society. The efficient use of coal in locomotives is also being encouraged and fathered by the coal producers. To meet the serious and growing competition of the Diesel locomotive those interested in burning coal have not been satisfied to stop at improved combustion efficiency and helpful auxiliaries but are studying the possibilities of major changes in design, such as the new steam-turbine locomotive. The gas-turbine locomotive is also under discussion at this time. The development of improvements resulting from this competition will be interesting to watch and will lead to better overall fuel efficiency.

Over Fire Jets Eliminate Locomotive Smoke

Smoke abatement and fuel efficiency go hand in hand. An outstanding development in auxiliaries this year in the coal-burning locomotive field is the reborn widespread interest in the use of furnace overfire jets. In the past, the application of jets has been of a rather hit-or-miss nature. Believing that some research on their action and application would be of value, Bituminous Coal Research, Inc., had studies made at the Battelle Memorial Institute. Its findings are reported in Technical Report VII, "Application of Overfire Jets," by Richard B. Engdahl.

As a result of this work, railroads have become interested in a restudy of overfire jets for locomotives. It is not a matter that can be brushed aside with the statement that "overfire jets have been in use a long time." The facts are that full advantage has not been taken of the possibilities of overfire jets. E. D. Benton, fuel engineer of the Louisville & Nashville, and associates have recently developed some very successful applications for locomotives. As a result of a public demonstration of these jets, the Nashville Smoke Commission chose publicly to thank the co-operating Nashville railroads, using such statements as:

"Yes, thanks for showing a representative group of city officials, railroad men and leading Nashville industrialists and engineers that your hard-working switch engines can and will be operated smokelessly."

"The demonstration which Nashville's three railroads put on last Thursday afternoon at Vine Hill seemed miraculous. One minute, operating without the newly perfected steam jets, three switch engines were belching out heavy black smoke, polluting the air all around them. Then, when the steam jets were turned on, the smoke vanished immediately and completely as if at the wave of a magician's wand."

". . . The railroads point the way, too, toward successful and economical use of soft coal. . . . The railroads point the way also by furnishing additional proof that proper combustion is the solution of the smoke evil on both the industrial and the domestic firing lines. . . . The Railroads Point the Way!"

After the war an intensive smoke-abatement drive is expected in many cities throughout the country. The railroads should be prepared to extend their fine work in some areas on smoke abatement to many more areas. Right now, the city of Alexandria, Va., just outside of Washington, D. C., is expecting the railroads, which create a major part of its smoke nuisance, to improve conditions. Experiments are under way to accomplish this needed result largely by means of overfire air-induction jets.

A committee of the American Society of Mechanical Engineers is now working on model sections for city smoke-abatement ordinances. As chairman of that committee, I have discussed with various railroad men what should be expected of the railroads. Not so many years ago it was generally conceded that the railroads could not do as good a job of smoke abatement as industrial plants. It is pleasing to report that those railroads that are doing good smoke-abatement work request that they be given only the same limitations as the industrial plants. In one case, a railroad man thought the contemplated limitation on smoke omission was too liberal. This all means that great progress has been made in smoke abatement by many railroads. There is considerable to be done, however, on some railroads.

The National Fuel Efficiency Program

It is not only important to develop equipment and proper operating methods to accomplish fuel efficiency and smoke abatement but a continuous training program and continuous application of these proper methods are also necessary. To prevent, as far as possible, all waste of our national fuel resources, the National Fuel Efficiency Program, in co-operation with the Bureau of Mines, is functioning as an aid to industrial and commercial fuel users. Except for a few paid Bureau of Mines employees, this program is being carried out by patriotic volunteer workers—thousands of them. The program includes visits to plants and the supplying of pertinent operating information. One of the real problems of this program was to devise a simple and truly effective way of presenting this information. Long write-ups will not be read. It was decided to prepare short one- or two-page quiz sheets, termed "Waste Chaser's Quiz Sheets," each covering the operation of some equipment item, and consisting of a number of thought-provoking questions and answers designed to effect continuous proper operating care.

Unfortunately, our program to date has not included a directly co-operating group of locomotive men. Plans have been considered, however, and Tom Cheasley, supervising engineer of our National Fuel Efficiency Sec-

* By permission of the Director, Bureau of Mines, this paper was contributed by the Railway Fuel and Traveling Engineers' Association's Committee on coal for the 1945 year book of the Association.

† Chief of Solid Fuels Utilization for War, Bureau of Mines.

tion, has conferred with your secretary, T. Duff Smith.

It is reported that the railroads used some 130,000,000 tons of coal in 1943, or something over one-fifth of the total coal consumption. Co-ordinated efforts to eliminate all possible waste in the use of this large tonnage of coal should result in a substantial saving. When less coal is used to accomplish the same work, there is a saving not only in coal tonnage but also in many other valuable war items reaching from the mine to the consumer, such as manpower, transportation, and equipment. Statistics show that coal production is not keeping up with coal consumption at present and also that the gap between them continues to increase. To prevent coal shortages in various individual plants, it is necessary to distribute the coal produced in a manner that results in the coal in storage at other individual plants being used, thus making up the difference between production and consumption. This extremely difficult and complex problem has been assigned to the Solid Fuels Administration for War. As a help on this problem, Solid Fuels Administration for War has cut the quantity of coal that can be distributed to householders. Elimination of waste of coal in industrial and commercial use would make the problem relatively easy.

The general plan of the National Fuel Efficiency Program as applied to industrial plants would have to be modified somewhat when applied to locomotives. It would appear that it would include renewed activities by supervisors along contact and educational lines, with the older operators being continually impressed with the need for eliminating waste and the younger operators given more training.

Often in operating programs a new approach to an old subject will obtain additional results. Consideration is being given to the preparation of quiz sheets, such as are used in the program, appropriate to locomotive operation. Each quiz sheet would apply to some specific operation item. The number and the subject matter of these sheets could only be decided by men of long and successful supervision of locomotive operation. The preparation of questions and answers for each sheet would bring from such men their cumulative experience and opinions. It would be an interesting problem for a committee of chosen men of this association.

It is hoped that by the time this is read progress will have been made in the development of plans for the co-operation of those responsible for the utilization of locomotive fuel with the National Fuel Efficiency Program. Any action that your association can take along these lines or any plans devised leading to the desired end are invited and would be greatly appreciated.

Passenger Cars — 1946 Models

(*Continued from page 6*)

same time moving large numbers of people at low cost.

In the luxury cars such as diners, lounge, and parlor cars we will see striking examples of the ultimate in decorative features and in new facilities such as private rooms, cocktail lounges, motion pictures, space for dancing, and children's play rooms.

The coaches will have less radical innovations but will include many refinements. Several railroads have been conducting surveys to determine passengers' preferences for those features which directly concern their comfort and convenience, and it is in these features that the greatest advancement will be made in the coaches of 1946.

Seats will be more comfortable both for day and night travel; lighting will be improved especially in the better application of fluorescent lighting; vestibules, end doors, and passageways will be wider for easy entrance and exit; improved arrangements for the stowage of luggage will be provided, and washrooms and toilets will be of ample size and equipped with new space-saving arrangements of washstands and vanity dressers.

The coach interiors will be treated in such a way as to produce highly pleasing effects of a restful rather than an exciting character. In this field the decorator will have many new materials available including plastics of a number of varieties, metal finishes such as aluminum anodized in natural finishes or colors, and many others. Synthetic floor coverings and plastic materials for window curtains and drapes are among the new materials now available.

Cleanliness is of the utmost importance to passenger comfort. Increased attention is being given to details which contribute to easy cleaning and maintenance. Coves at partitions, concealed piping, and the elimination of inaccessible corners are important items. Air ducts are being made with access doors to permit regular and thorough cleaning. Odor absorbers and germicidal devices insure clean fresh, healthful air with the temperature closely regulated within the comfort zone, regardless of the season. Such coach equipment, offering maximum safety and comfort, will certainly attract passenger travel to the railroads in such volume as to permit profitable operation at low cost to the traveler.

Standardization Trends

It is apparent that there is going to be wide variety in the 1946 passenger train cars. This is true, not only of the various types of cars for distinctly different services, but even for cars of the same type such as coaches. Floor plans differ for each railroad, some requiring small toilets and maximum seating capacity, others desiring large washrooms and exceptionally wide seat spacing. Framing materials and even designs produced by the several builders of the same basic material vary greatly in detail. This diversity requires large engineering forces, increases costs, and hampers production by the builders.

Complete standardization is hardly possible at this stage in the development of the modern lightweight passenger train car and standardization, however desirable from a production standpoint, should never be maintained to the point of stifling progress. Much more, though, can be done without approaching this danger zone.

A welcome trend in this direction is in progress. A length of 85 ft. over coupler pulling faces and the A. A. R. cross-section dimensions are generally accepted. The roller bearing axle is being standardized and some uniformity of four-wheel truck designs is developing. Further steps in the direction of standardization are highly desirable for cost reduction.

The first lightweight streamline equipment was built as trains consisting of cars of the several types needed. Some of the 1946 equipment is to be built in the same manner, that is, in one or more complete train consists for particular runs. More and more, however, cars are being built in fairly large numbers of the same type, which result in lower costs. This plan will eventually permit the railroad following it to replace all of its obsolete heavy equipment and, while doing so, to operate the new and old equipment in the same trains.

Regardless of the plan followed the need for new equipment is clearly indicated by the fact that about 50 per-cent of existing passenger train cars is more than 25 years old and only about 4 per cent is less than 10 years old.

EDITORIALS

Machine Tool and Equipment Buying Unusually Heavy in 1945

A survey made by *Railway Mechanical Engineer* of the buying of machine tools and shop equipment in 1945 indicates that orders were placed for more of this class of equipment by the railroads in the year just ended than in any year since pre-depression days. The reports came in from railroads representing over 221,000 route miles and an equipment ownership of 39,800 locomotives, 1,749,000 freight cars and over 25,000 passenger cars. The roads certainly have taken advantage of their improved financial condition and the freedom from buying restrictions to replace substantial portions of obsolete and worn out equipment in their car and locomotive shops and engine terminals.

A glance at the lists of purchases for an industry as big as the railroads is always an interesting occupation, for it is amazing what a wide variety of products a railroad must have to keep its many functions in operation. The items required in the average shop and enginehouse range all the way from a single drill or pin, costing a few cents, to a machine tool that may cost 30 or 40 thousand dollars. These purchasing lists are also a most accurate reflection of the changes that are taking place in the running of a railroad.

The use, by the railroads, of the many hundreds of Diesel-electric locomotives has not only been the occasion for the construction of many new shop and terminal facilities for maintaining this type of power but has brought into the railroad market many new types of devices and products that are required for the inspection, servicing and repair of the internal combustion engines, and the electrical equipment new to the many roads formerly operating only steam power.

There has also been a feeling that the introduction of Diesel power would eliminate the necessity of maintaining the facilities used for steam locomotives, but a glance at the purchases of shop equipment and machine tool items for 1944 and 1945 is the best of evidence that most roads feel that the steam locomotive is going to be an important part of their motive power inventory for many years to come. Not only is the buying for shop equipment used specifically for steam locomotive repairs heavy in volume but the character of the needs of the roads is an indication that the day is gone when tolerances of the "two-foot-rule" variety can be accepted around a railroad shop. The modern locomotive, of whatever type, is a precision machine and the tools used in its maintenance must be capable of extreme accuracy.

It is gratifying to see, after the seeming indifference of many years had resulted in the gradual decline in the efficiency of the railroad shop, and particularly of machine shop operation, that the roads are finally taking the opportunity to bring their plants up to date. As has been pointed out many times in the past, the expense of locomotive repairs still remains the largest single item of railway operating expense and if the facilities with which motive power is maintained are obsolete this major expense item cannot help but increase at a time when the roads, in the years to come, are to be faced with the stiffest competition in their history. Only efficient motive power and modern maintenance facilities can minimize this expense.

Standardization Trends During the War Emergency

Simplification and standardization of the cars and steam locomotives delivered to the Military Railway Service was an outstanding achievement in the construction of equipment for the armed forces. Production, logistics, and maintenance dictated the adoption of designs that could be produced quickly; that could be transported, with replacement parts, to the combat theatres in a minimum of shipping space and that guaranteed reliability and an interchangeability of parts for speed in repairs. Delays on any railroad are costly but delays on the trackage of the M.R.S. could cost lives. It is a safe guess that even the costs in dollars, while unimportant, were much less than could have been attained without simplification and standardization.

On the other side of the Rhine the Germans had to simplify the methods used in the production of cars and steam locomotives for different reasons, the principal one being the lack of skilled labor. Investigators have found that the greatest development in the German railway industry was in the adaptation of automobile production methods to the manufacture of locomotive parts. To set up jigs and fixtures for volume work they had to adopt one standard design, a 2-10-0 type locomotive that has turned in an acceptable performance under service conditions.

On this side of the Atlantic steam locomotives built to meet the particular operating conditions of one railroad found themselves hauling war tonnage on strange tracks over territory that did not duplicate the profile of the line for which they were designed. Pos-

sibly the locomotives did not give sufficient recognition to the differences in scenery and grades, being less observing than their designers, and just went ahead demonstrating again their well-known adaptability. The performance of these locomotives may give added weight to the estimate made in 1943 by Brig. Gen. C. D. Young that two designs of 4-8-4 type locomotives, instead of the ten designs delivered, could have met the needs of the railroads.

These abnormal conditions required and got unusual treatment. While the extreme measures of war may not be justified in peace, the developments made in war time should be investigated for peace-time applications. The advantages of a greater standardization of steam locomotives, without retarding improvements in design, have been mentioned many times by the builders. Progress toward this objective might well be accelerated by the study of the advantages attained during the war emergency.

Electric Motive Power

In the field of electrification, the most interesting developments of the new year are motor-generator type electric locomotives being built by the General Electric Company, respectively, for the Virginian and the Great Northern. There will be four two-cab locomotives for the Virginian designed for heavy coal-haulage over the Allegheny Mountains which will carry a million pounds on 16 driving axles. The two Great Northern locomotives will each weigh 360 tons, also with all weight on drivers, and will bear the distinction of being the largest single-cab locomotives ever built. Also during the year, American manufacturers have received orders for 42 electric locomotives from South America. These include 26 freight and passenger units for the Sorocobana, 6 passenger and 6 switching for the Paulista and 6 freight and passenger for the Central of Brazil. One abandonment of an electrification seems imminent on the Boston & Maine. Smoke conditions made this tunnel electrification necessary and the Diesel-electric locomotives now being used by this railroad are able to negotiate the tunnel without difficulty.

To an electrical man, a Diesel is an electric locomotive to which has been added one or more Diesel engines. As seen from this point of view, it is interesting to note that the total continuous horsepower of electric locomotives in service on Class I railroads is about 2,125,000. On the other hand, these railroads now use Diesel-electric locomotives which have a total rated horsepower of 4,300,000. Since Diesels, unlike most electrics, must have generators as well as motors, the total electrical machine horsepower represented is almost four times as much for Diesels as it is for electrics. In the case of electric locomotives, there must also be generating equipment at power houses and perhaps rotating machinery in substations, but for large electrifications, the generator capacity required is only about one-third of that of the traction motors, is fixed rather than mobile, and is owned in large part by utilities.

Early in 1945, work was started on three coal-burning, steam-turbine-electric locomotives for the Chesapeake & Ohio. They will develop 6,000 hp. and will have a top speed in excess of 100 m.p.h. A steam turbine driving a 4,000-kw. generator will supply power to a motor on each driving axle. The next unit to be built is expected to develop 7,000 hp.

There has been much speculation concerning the time when gas-turbine locomotives will become a practical form of railroad motive power. Estimates vary from two to twenty years. To the electrical industry, it is another locomotive which will probably employ electric drive.

New, and capable, competition for road locomotives using electrical transmission are the T-1 and Q-2, four-cylinder steam locomotives, and the geared steam-turbine locomotive, all in the service of the Pennsylvania. The T-1s, for example, possess operating characteristics comparable with the Pennsylvania's GG-1 electric locomotives. The geared turbine locomotive which has great advantages of simplicity has completed a year of successful operation.

Newcomers in the road Diesel field are the 3,000-hp. locomotive just completed by the Baldwin Locomotive Works for the Seaboard and the 6,000-hp. locomotives produced by Fairbanks, Morse & Company for the Union Pacific. The Seaboard locomotive will be the first Diesel to use a locomotive running gear, and the Union Pacific will employ a type of Diesel engine which has given an excellent account of itself in submarine service. In its freight locomotives Electro-Motive is increasing the power-plant capacity per cab to 1,500, thus providing a rating of 6,000 hp. for its four-unit locomotives.

All in all, the situation is one in which there is good healthy competition which should result in marked improvements in railroad motive power.

Present Labor Conditions In the Mechanical Department

A recent analysis of mechanical-department labor conditions discloses some interesting information regarding the way in which railroads met the problem of getting skilled and unskilled labor to maintain equipment last year and what the prospects are for 1946.

A number of individual roads report no great difficulty in maintaining adequate mechanical forces, particularly in the latter part of 1945, and look forward to restoring the department to full strength in 1946, with the release of additional men from the armed forces and war production plants. For supervisors on the great majority of roads, however, 1945 proved a year of constant struggle to acquire and retain sufficient man-power

so that locomotives and cars could be kept in condition to handle the peak military and civilian rail traffic which was offered. As a matter of fact, everything was sacrificed to this objective, including much heavy repair work which is now long overdue, partly because of the lack of necessary repair forces and partly because the equipment could not be spared from active service long enough for shopping.

The actual deficiency of labor for mechanical work throughout the country is indicated by Railroad Retirement Board reports which show for the month ended October 31, 1945, a shortage of about 6,300 skilled trades journeymen, including 2,603 carmen, 1,715 machinists, 525 boilermakers, 217 sheet-metal workers, 207 pipe fitters, 202 car inspectors. A total shortage of about 3,900 helpers and apprentices included 1,004 carman helpers, 858 machinist helpers, 456 machinist apprentices, 337 carman apprentices and 246 boilermaker helpers. In addition, there was a shortage of 4,558 shop laborers and 781 car cleaners. Primary difficulty in getting adequate help occurred in industrial regions such as San Francisco, Cal., Chicago, New York, Kansas City, Mo., and Cleveland, Ohio.

In view of these labor shortages, how were railroads able to maintain equipment and service it for the necessary high availability and utilization in 1945? They advanced experienced helpers and apprentices (those who remained in service) to mechanics, special efforts being made to instruct these men in the safe and efficient performance of their work. Laborers were promoted to helpers, but required similar special instruction. The shortage in unskilled labor was partially met by the employment of women on work within their capacity and in some instances by the use of Mexican labor.

In spite of their best efforts, however, railroads generally experienced a shortage of help which resulted in the payment of penalty overtime and added appreciably to equipment maintenance cost. On one road, for example, a normal overtime of about five to six per cent of the payroll was increased to twenty-five per cent in 1945 in both the locomotive and car departments. Still another difficulty which became particularly evident on termination of the war was the large amount of absenteeism caused by men who seemed willing to take time off for the slightest excuse or none at all. A growing disinterest in shop work and unwillingness to accept responsibility, doubtless reflecting general labor unrest throughout the country, also undoubtedly operated to retard maintenance work.

The difficulty which railways may have in recruiting mechanical forces in 1946 is reflected in the following results of interviewing about 55 applicants each week since V-J day at one large railroad shop: 25 per cent refused employment because of dissatisfaction with wage payments; 40 per cent were not qualified under shop craft rules; 5 per cent were undecided; and 30 per cent employed. Of the men employed, 80 per cent worked as helpers and 70 per cent of these resigned within 30 days, giving the following reasons: 55 per cent said the work was too heavy and earnings not satisfactory; 22 per cent said the work was too dirty; and 23 per cent said they had better-paying jobs to go to.

In spite of some discouraging aspects, however, the mechanical department labor picture is much brighter than a year ago and progressive managements will find ways to acquire and develop sufficient labor, both skilled and unskilled, to carry on the extensive maintenance programs now planned. More and more experienced shop men will be released from military service. Machinists and mechanics from defense plants and national armories will be looking for work. Greater emphasis will be possible on apprentice training. Helper and unskilled labor forces will be recruited and the morale of all mechanical department labor improved as soon as the present general labor situation is clarified.

NEW BOOKS

MACHINIST'S AND DRAFTSMEN'S HANDBOOK—*By Albert M. Wagener and Harlan R. Arthur. Published, 1945, by D. Van Nostrand Company, Inc., 250 Fourth Ave., New York. 662 pages, 5 in. by 8 in. Bound in Fabrikoid. Price $4.50.*

The purpose of this book, according to its authors, was to present, in a small volume, the basic information required by machinists and draftsmen in a great majority of their daily tasks. It was recognized by the authors that, in adhering to this objective, much that might be considered useful and important would, of necessity, have to be omitted. There have been many attempts, particularly during the war years, to give machinists and designers information and useful data of a mechanical or mathematical nature in small handbooks or pamphlets and many of these have proved disappointing.

In this volume, however, the selection of material seems to have been made with considerable good judgment and it is quite probable that the man in the shop or drafting room can find the answers to most of his design or machining problems within its covers. Having, as a matter of policy, cut down the number of general subjects covered the authors have been able to cover certain of the included subjects in somewhat more detail. This is particularly true of some of the chapters on machine operation data and on the solution of mathematical problems. In this latter subject recognition is taken of the fact that, among shop men particularly, mathematics is a quickly forgotten subject and every effort is made in the subject material to simplify not only the solution but the understanding of the problem.

In addition to the customary mathematical tables—squares, roots, logarithms, circles—there are chapters on gearing, threads, drilling and milling, speeds, feeds, cutting tools, dies and presses, metals, strength of materials and mechanics.

With the Car Foremen and Inspectors

Wheel-Type Welding Jigs

Two wheel-type jigs used in welding freight-car-truck bolsters and side frames at the Milwaukee, Wis., shops of the Chicago, Milwaukee, St. Paul & Pacific greatly expedite the work of repairing and reclaiming these important parts for subsequent service under Milwaukee equipment.

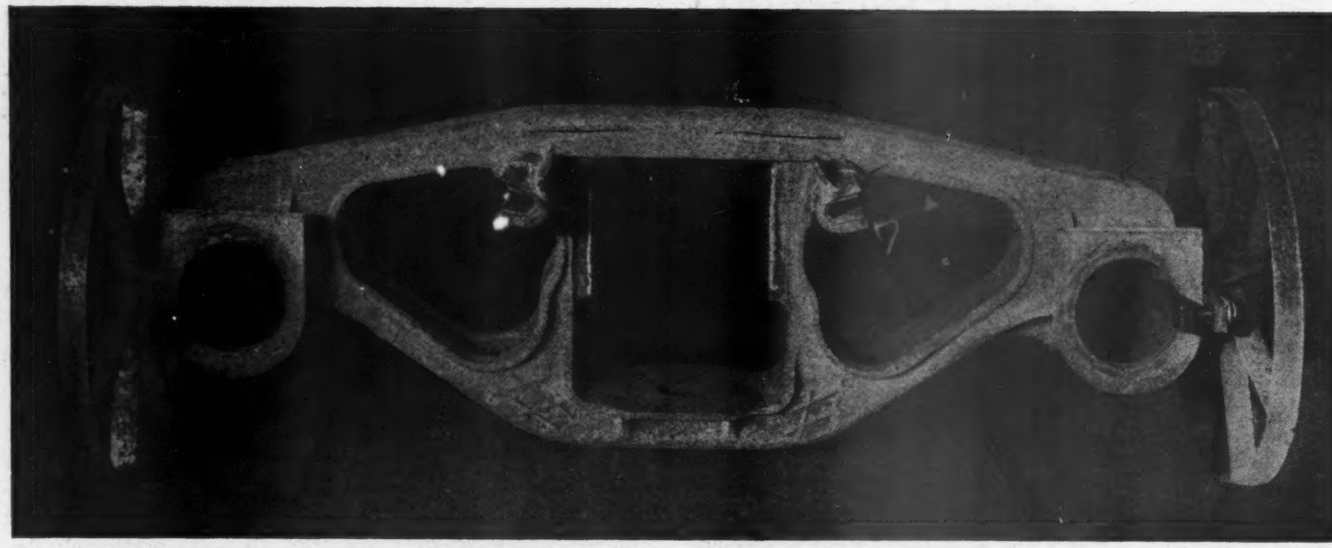
A truck side frame is supported on two wheels by means of clamps around the outer journal-box walls in such a way that the side frame just clears the floor and may be revolved to any desired angle for welding by simply turning the wheels and blocking them at the desired position. This permits down-hand welding of all cracks and worn surfaces in the side frame except on the inside surfaces of the column guides which are in a vertical position. All cracks are veed out with a cutting torch and electric welded. Column wear surfaces are built up by electric welding or brought to standard width by the application of steel wear plates plug-and-edge welded in place.

Each wheel is built up or is made of a ⅜-in. by 2-in. steel rim, 30 in. in diameter, with eight flat spokes of the same material welded to a hub which carries one fixed and one loose steel strap, ⅝ in. by 2 in. by 20 in. long, which can be bolted around the outer journal-box wall. This side-frame supporting wheel is inexpensive and easy to make and enough can be provided for as many welding gangs as are required to turn out the desired number of side frames. The work is generally specialized, six welders being used in a gang, two men welding columns (one on each side), two men welding brackets (one on each side), one welding cracks and another pick-up welding. The side frames are welded as they roll past the welding position and subsequently annealed in a car-bottom furnace for stress relieving before being placed in service.

Another slightly different type of wheel is required for supporting the truck bolster while being welded. In this instance, also, the wheel is made of ⅜-in. by 2-in. strap steel, 30 in. in diameter, and has welded spokes of the same material which, instead of extending into a central hub, terminate in a center rectangle 9¾ in. by 16¼ in. which is large enough to slip over the end of the bolster and be tightened or held in place by means of L-shape ¾-in. hand screws on three sides of the rectangle. This construction with hand-screw adjustment permits locating the bolster with its center of gravity approximately on the wheel center line and hence the bolster may be easily moved by rolling the wheels until the desired position is secured for most convenient, down-hand welding. In this instance, also, the welding is specialized, individual welders being used to build up worn surfaces and weld cracks.

These weld-jig wheels can be easily applied and rolled to the welding crews who confine their efforts to welding.

Special wheels with rectangular center openings to accommodate bolster ends



Weld jig wheels applied to a freight-car truck side frame

The use of this type of jig improves both the quality and quantity (per man) of welding work in connection with the repair and reconditioning of truck sides and bolsters.

Air Brake Questions and Answers

HSC Equipment on Passenger Cars and Diesel A and B Locomotive Units Brake Application

Operation of the Independent Brake Valve

(Continued)

336—*Q.—How does this position affect the D-22-ER control valve?* A.—In the application and release portion of the D-22-ER control valve, main-reservoir pressure flows through passages *6* and *6a* to chamber *D* of the application piston *255*. As chamber *G* on the face of the application piston is open through actuating pipe *13* to atmosphere at the independent brake valve, main-reservoir air holds the piston *255* and its slide valve *257* down.

337—*Q.—Describe the build up of straight-air pressure when an electro-pneumatic application is made at the MS-40 brake valve.* A.—When an electro-pneumatic application is made at the MS-40 brake valve, straight-air pipe pressure is built up by the No. 21-B magnet valve, as previously described, and flows through straight-air pipe *8* to the application and release portion of the D-22-ER control valve, thence through passage *8*, cavity *n* in application slide valve *257*, and passage *8a* to the chambers above double check valves *263a* and *263*. These check valves are thus held on their lower seats, check valve *263a* thereby closing off passage *20a* leading to the independent application and release pipe thence to the brake-valve exhaust, and check valve *263* closing off passage and pipe *3* leading to the displacement reservoir and the control-valve exhaust. Flow continues through passage *16c* to passage and pipe *16* to the FS-1864 relay valve.

338—*Q.—Describe the build up of brake cylinder pressure when an automatic application is made at the MS-40 brake valve.* A.—When an automatic brake application is made at the MS-40 brake valve, the service piston of the D-22-ER control valve moves to application position where the graduating valve uncovers service port *f* and the slide valve moves this port into register with port *3b*, permitting auxiliary-reservoir air in the service slide-valve chamber to flow through passages *3b, 3a* and *3*, in the independent application and release portion, to the displacement reservoir, and to the underside of double check valve *263*, which is moved to its upper seat, sealing off straight air pipe pipe passage *8a* which is open to exhaust at the No. 21B magnet valve, and uncovering passage *16c* through which flow continues to passage and pipe *16* and to the FS-1864 relay valve, which reproduces brake-cylinder pressure as adjusted by the speed governor.

339—*Q.—How is an independent application obtained?* A.—By moving the handle of the independent brake valve to the right, the farther the movement the greater the pressure obtained.

340—*Q.—How do the operating parts respond to this movement of the handle?* A.—As explained for the MS-40 brake valve, the self-lapping portion operates to close the exhaust and admit main reservoir air to the brake valve cavity *B* in an amount corresponding to the handle position in the application zone. Poppet valve *25* is held unseated in the release and application zones, permitting main reservoir air to flow from cavity *B* to the straight air application and release pipe *20*, thence to the application and release portion of the D-22-ER control valve.

341—*Q.—Describe the flow of air after reaching the control valve.* A.—At the control valve the air flows through *passages 20* and *20a* to the lower face of the check valve *263a* which is moved to its upper seat, sealing off the straight air pipe connection *8a*, and uncovering the *16d* connection to the top of check valve *263*, which is thus held on to its lower seat, sealing off the displacement reservoir and control valve exhaust passage *3*. Flow continues to passages *16c* and *16* and thence to pipe *16* and the FS-1864 relay valve which reproduces brake cylinder pressure as adjusted by the speed governor.

342—*Q.—What happens as the handle of the S40C independent brake valve is moved toward release?* A.—The self lapping portion operates to reduce application and release pipe pressure an amount corresponding to the handle position, the release flow from the D-22-ER control valve application and release portion being the reverse of that in application position.

343—*Q.—What happens to the relay valve?* A.—With the handle returned to release position, the air is completely exhausted from the relay valve which makes a proportionate release of brake cylinder pressure, subject to speed governor adjustment.

344—*Q.—How can the brake on the locomotive be independently released after electro-penumatic or automatic application?* A.—By depressing the independent brake valve handle in *release position.*

345—*Q.—How is the application pressure built up at the control valve with the electro-pneumatic or automatic brake applied?* A.—Application pressure in passage *16* from either the straight air pipe or the displacement reservoir flows through passage *16a* to the outer area of quick release piston *269* and thence through a choke in the release piston to the spring chamber, thence through passage *16b* past ball check *253* and *16f* to the slide valve seat where the slide valve blanks further flow. Pressure thus builds up equally on both sides of the quick release piston *269,* and spring *271* holds the piston seated.

346—*Q.—How is the release accomplished by depressing the independent brake valve handle?* A.—When the handle is depressed it contacts a bail which depresses plunger *20* which moves valves *21* and *21a* down. Valve *21* is held seated, closing the actuating pipe exhaust and valve *21a* is unseated, permitting main reservoir air from pipe *21* to flow to the actuating pipe *13,* and thence to the control valve where it builds up in chamber *G* on the face of application piston *255.* As main reservoir pressure back of the piston is equalized with main reservoir pressure on its face, the piston is balanced and spring pressure moves the piston and slide valve *257* to their upper position, where the slide valve cavity *n* connects passages *16f* and *20.*

347—*Q.—What does the junction of these two passages have to do with the release?* A.—As passage *20* is open to the independent brake valve exhaust through the independent application and release pipe, air flows from passages *16b* and *16f* and the spring chamber of release piston *269* at a faster rate than it can be supplied through the choke in the release piston, and the greater pressure from passage *16a,* acting on the outer area of the piston, unseats it, permitting straight air pipe or displacement reservoir air to flow to atmosphere, thus effecting a fast release of application pressure from passage *16* and pipe *16.*

348—*Q.—How, then, is a fast release of locomotive brakes effected?* A.—A proportionate release of brake cylinder pressure is made by the FS-1864 relay.

349—*Q.—Can the locomotive brake cylinder pressure be graduated off after an electro-pneumatic or automatic application?* A.—Yes.

350—*Q.—How is this accomplished?* A.—By depressing the brake valve handle in the application zone.

351—*Q.—What determines the amount of pressure?* A.—The amount of pressure retained is approximately the amount corresponding to handle position. In other words, just as the pressure is increased in independent application by moving the handle forward in the application zone, so it may be decreased after either automatic or electro-pneumatic application by depressing the handle in the application zone and moving it toward release.

352—*Q.—Explain how the pressure is decreased or increased by the handle movement.* A.—As previously described, when the brake valve handle is depressed, the application piston *255* and slide valve *257* of the control valve are moved to their upper position, the slide valve cavity *n* connecting the application and release pipe to passage *16f* and the spring chamber of the quick release piston *269.* If the straight air pipe or displacement reservoir pressure in passage *16a,* acting on the face of the quick release piston, is higher than the independent application and release pipe pressure in the spring chamber, the higher pressure will unseat the release piston and reduce to atmosphere until it is approximately equivalent to independent application and release pipe pressure, at which point the spring seats the release piston and retains the remaining straight air pipe or displacement reservoir pressure.

353—*Q.—What precaution must be taken to prevent re-application during an electro-pneumatic application when a graduated release is desired?* A.—The independent brake valve handle must be held depressed or the

* * *

Well-guarded swing saw used in a railway mill room—The large high-speed saw and driving belt are provided with steel guard sheets secured to the swing frame, and the saw swings back into a removable steel hood bolted to the back of the saw table

brake will re-apply immediately since the MS-40 brake valve handle is in application position.

354—*Q.—What provision is made to prevent application of locomotive brakes during an electro-pneumatic brake application when desirable in grade operation?* A.—Locking position, the extreme left handle position, is provided to prevent this application.

355—*Q.—Explain this feature.* A.—In this locking position the brake valve handle is held depressed. As previously described, the handle then unseats valve *21a* and admits main reservoir air to the actuating pipe *13* which holds the application piston *255* and slide valve *257* of the control valve in their upper position. Passage *8* is blanked by the slide valve, preventing flow of straight air pipe air to passage *8a* and the FS-1864 relay valve, and, therefore, the locomotive brakes remain released.

356—*Q.—Can the automatic emergency application be obtained on the locomotive in locking position?* A.—Yes.

357—*Q.—Explain how the emergency application is obtained in this position.* A.—In this position of the handle, the handle cam controlling the position of dog *15* and poppet valve *25* are moved out of contact with the valve stem, and spring *28* seats the poppet valve, closing connection between the application and release pipe *20* and chamber *B* of the brake valve which is open to the brake valve exhaust through unseated exhaust valve *64* of the self lapping portion. In the D-22-ER control valve, application slide valve *255* is in its upper position, connecting the independent application and release pipe *20* to passage *16f*. With the independent application and release pipe closed at the brake valve poppet valve *25*, pressures are thus equalized on both sides of quick release piston *269* so that spring *271* holds the piston seated, preventing exhaust of pressure from passage *16a* and thus allowing flow from the straight air pipe or displacement reservoir to the FS-1864 relay valve if automatic emergency application is made.

358—*Q.—With the independent brake valve in locking position will the locomotive brakes apply when an automatic service brake application is made?* A.—Yes.

359—*Q.—What is this due to?* A.—The closing of the independent application and release pipe at the independent brake valve poppet valve *25* as explained previously. Under this condition the brake valve handle must be moved out of locking position to release brakes.

360—*Q.—What does this insure against?* A.—This protects against leaving the handle in locking position.

361—*Q.—For what other reason may the locking position be used?* A.—To retain locomotive brake cylinder pressure lower than that obtained in car brake cylinders during an electro-pneumatic brake application.

362—*Q.—How is this accomplished?* A.—By depressing the brake handle at the desired point in the application zone and quickly moving it to locking position.

363—*Q.—What must be done in this event to obtain a release of locomotive brakes?* A.—It is necessary to remove the handle from locking position.

Automatic Brake

364—*Q.—How is the MS-40 brake valve shifted from HSC to automatic pneumatic control?* A.—Put the brake valve handle in release position, pull out the shifter lever latch and swing the shifter lever 180 deg. and release the stop pin into the hole in the brake valve body casting. This location is farthest from the operator with the letters A.U. exposed to view.

365—*Q.—What is the result of this action?* A.—This action disengages the brake valve handle shaft from the self lapping portion, which thereafter remains inactive, and engages the lower shaft *80*, controlling the rotary valve *54*, with the handle shaft.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Measurement of Wheel-Seat Diameter

On January 27, 1943, the Chicago, Milwaukee, St. Paul & Pacific applied a new pair of wheels and a second-hand axle to car NWX 70445 because of worn wheels and a wheel-seat diameter of 6$\frac{3}{16}$ in. The wheels and axle removed had been applied on December 30, 1940, by the C. M. St. P. & P. at which time the wheel-seat diameter had been reported as 6¼ in. The railroad stated that the wheel seat was found to be 6¼ in. upon removal but the wheel seat required that a cut of at least $\frac{1}{32}$ in. to recondition the seat for remounting. This cut would have reduced the wheel-seat diameter to 6$\frac{3}{16}$ in. or below the A. A. R. second-hand limit. The C. M. St. & P. believed that Paragraph 217, A. A. R. Wheel and Axle Manual supported its wheel shop practice of taking a slight cut from the wheel seat when warranted and felt justified in allowing only scrap credit for the axle. The car owner contended that wheel-seat measurements should be taken before turning the axle and without any allowance for metal removed during the turning operation, and if the axle was second-hand when applied it was second-hand when removed. The owner believed arbitration decision 1782 is parallel.

In a decision given on April 12, 1945, the Arbitration Committee said, "The repairing line found that it would be necessary to make a cut on the wheelseat before remounting as recommended in Paragraph 217 of the Wheel and Axle Manual. This would have reduced the diameter of the wheel seat to 6$\frac{3}{16}$ in., which is below A. A. R. condemning limit. Therefore, the contention of the Chicago, Milwaukee, St. Paul & Pacific is sustained." *Case 1810, Northwestern Refrigerator Line Company versus Chicago, Milwaukee, St. Paul & Pacific.*

Damage to Cars by Heating

In a circular letter dated November 28 Secretary A. C. Browning of the A. A. R., Mechanical Division, submits the following comments by the Arbitration Committee regarding damage to car structures by use of heating devices to facilitate unloading of frozen coal and similar commodities:

Because of the unusually severe winter of 1944-45, the railroads and consignees of coal and other bulk shipments in open-top cars found it very difficult to unload the cars on account of moisture in the commodities freezing so that they would not flow readily through the hoppers or door openings. Various means were used to loosen or thaw the lading to facilitate unloading.

Heat when properly applied and adequately controlled affords a satisfactory and effective means for dislodging frozen lading, but when open flames of high temperature are concentrated on vital parts of cars, warping, sagging, distortion and other damage is caused which frequently

results in the equipment being rendered unserviceable and requiring considerable expenditure for repairs.

It is the obligation of individual railroads to prevent damage to foreign cars in their possession and to use their influence to insure that industries and other consignees on their line will adopt and use unloading methods that will not be destructive to car equipment, and where heat is used to advise them of the proper use, to avoid the damage that has been experienced in the past.

Provisions are being incorporated in the interchange rules effective January 1, 1946, to make the handling line responsible for damage to cars resulting from open flames used to thaw out frozen lading where the damage is in excess of specified limits, and thereafter defect cards will be required in interchange so that the cost of repairing the damage will be borne by the railroad on (or industry) which the damage occurred.

In order to avoid this penalty and to obviate the necessity of such cars being removed from service to effect repairs, it is recommended that individual railroads take appropriate action to check the unloading conditions on their lines and co-operate with industries and consignees to the end that frozen lading will be unloaded with the minimum of damage.

No More Splicing Of Air-Brake Hose

In a circular letter dated December 5, A. C. Browning, secretary of the A. A. R., Mechanical Division, advises that a plentiful supply of synthetic rubber is now available for manufacturing new air-brake hose and the Committee on Brakes and Brake Equipment has recommended that the emergency measure permitting the use of spliced air-brake hose be abrogated. He states that the Arbitration Committee concurs in this recommendation and has modified the interchange rules involved, effective January 1, 1946, to prohibit the application of spliced air hose to cars moving in interchange service. However, the interchange of cars which were equipped with spliced air-brake hose prior to the above date will be permitted for a maximum one-year period (until January 1, 1947) unless the spliced hose should become defective in the meantime.

Maintenance of AB Accelerated Release Piston Portion

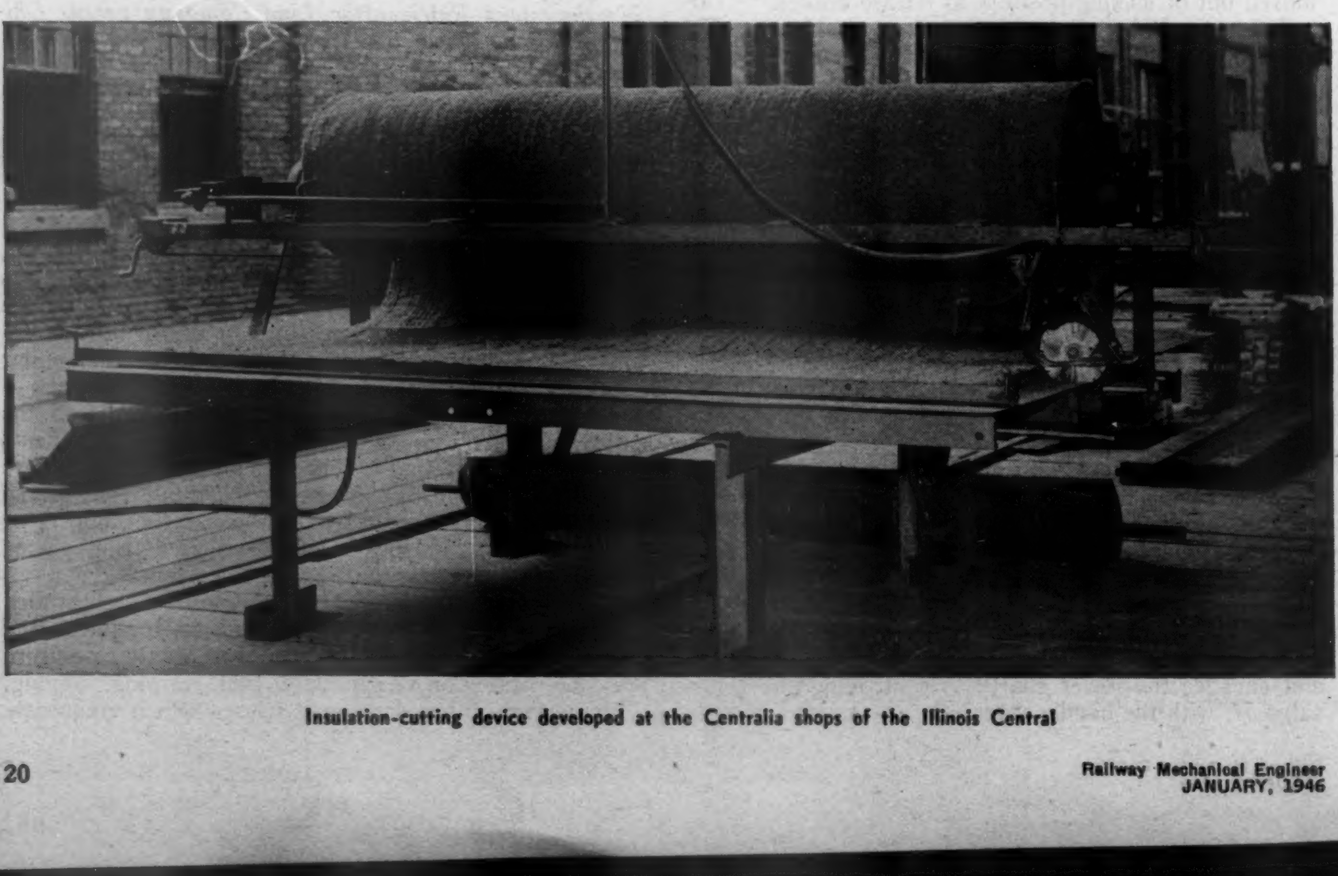
In a circular letter dated December 4, Secretary Browning calls attention to the note on page 13 of A. A. R. Instruction Leaflet No. 2391, dated June, 1945, as published by the Westinghouse Air Brake Company and the New York Air Brake Company, reading as follows: "*Important:* All valves now having accelerated release pistons must not be converted to use emergency portion covers without accelerated release pistons until authorized by the A. A. R." The secretary says that the Committee on Brakes and Brake Equipment has now authorized the replacement of defective accelerated release caps with plain caps.

Illinois Central Car Shop Devices

Insulation Cutter

The illustration shows an insulation cutter developed and successfully used at the Centralia, Ill., car shops of the Illinois Central, but adapted to use at other points on this railroad where refrigerator, caboose or passenger car insulation has to be applied in connection with heavy car repair or rebuilding programs. This material is somewhat awkward to cut and handle by ordinary methods. The device does this work quickly and leaves smooth edges.

It will be noted that a sheet-metal table is located at a convenient height above the shop floor and equipped with an A-frame bearing at either side to support the long roll of insulating material wound about a steel center bar which rests on rollers in the A-frame bearings. Welded to the A-frames is a built-up stationary cross-rail with



Insulation-cutting device developed at the Centralia shops of the Illinois Central

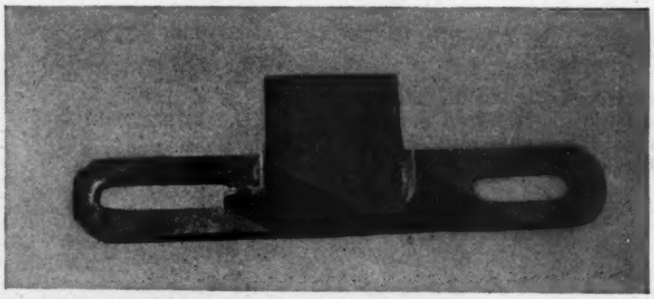
a sliding head which carries an electric-motor-driven saw with the saw blade extending down into a groove in the horizontal table. The circular saw and sliding head are traversed across the table by means of a small endless belt, pulley and handle, which is shown at the left side of the table.

An adjustable angle-iron stop, shown at the front of the table, can be moved and easily clamped the desired distance from the saw-travel groove. In operating this device, therefore, it is necessary only to unroll the insulation until its edge hits the angle-iron stop. Operation of the saw across the table in a back-up direction so the saw teeth cut downward then quickly and neatly cuts off a piece of insulation of the desired width.

The insulation illustrated is a roll of hairfelt used in the construction of caboose cars. Paper-faced insulation, a roll of which is shown on the floor under the device, may be cut with equal facility.

Shop Coupler Or Drawbar

In order to move a small cut of cars from one position to another in a progressive "spot-system" repair shop or yard, it is necessary to couple the cars together and this is not always easy, especially when couplers and draft gears may be out, as required for repair work at some of



Shop drawbar used in coupling cars together when couplers and draft gears are out

the spots. This problem is met at one of the large car repair points of the Illinois Central by means of the shop coupler, or drawbar, shown on the ground in one of the illustrations and applied to a single car in the other.

The shop drawbar applied to one car with coupler key in place

This drawbar consists mainly of a 1¼-in. by 5½-in. by 39-in. steel bar, provided with slots in either end, 2 in. wide by 7 in. long, to receive the coupler keys and having a ⅞-in. by 10-in. by 10-in. steel plate welded at the center to bear against the respective coupler castings and keep them apart. To assure this plate remaining at right angles to the coupler castings, four short sections of 3-in. angles (each 5-in. long) are welded to the drawbar at right angles to the separator plate, as illustrated. The drawbar is thus always kept in approximate alignment with the center line of the car.

This shop drawbar is relatively light and may be applied in the coupler castings and the coupler keys put in place entirely by hand, but it is safe to support it from a crane-equipped truck or other suitable means while moving adjoining cars together so the coupler keys may be inserted.

Once applied, the use of these shop drawbars is a definite safety feature as there is no chance of the cars unexpectedly running together while they are being moved on the shop tracks. Damage to coupler castings is avoided, cars are properly spaced, and it is no longer necessary to move one car at a time or use chains or other improvised methods of tying the cars together.

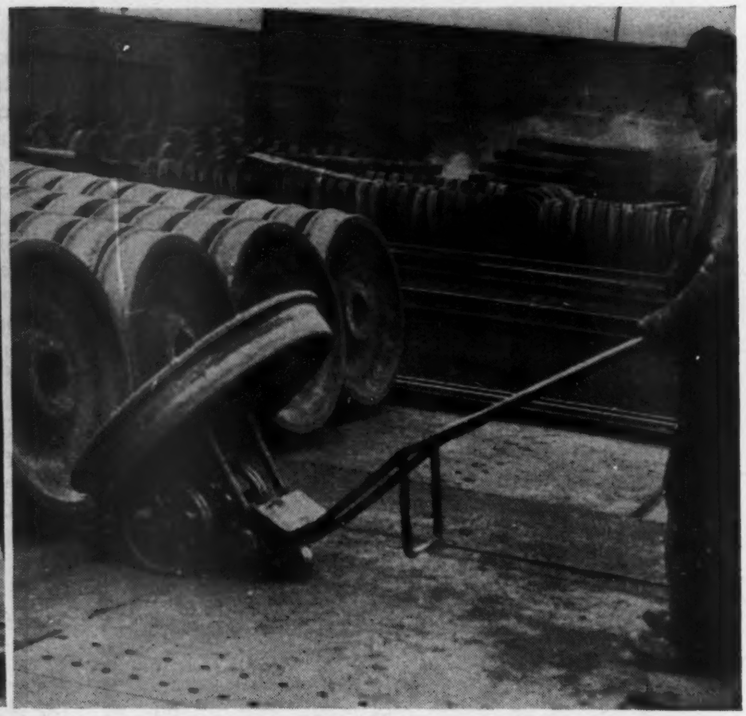
Car-Wheel Hand Truck

A car-wheel hand truck, developed and successfully used for about a year at the Markham, Ill., wheel shop of the Illinois Central is shown in the illustration. Unlike car-wheel power-lift trucks of various sorts, it can be operated in congested spaces. It avoids hand rolling; contributes to safety; and enables one man to supply a large wheel shop. As a matter of fact, the shop man who conceived the idea of this truck received an award under the I. C. Employees' Suggestion System and recognition by the War Production Board.

At the Markham wheel shop, this device is used for moving carwheels from storage to the shop and dismounted second-hand wheels suitable for further use back to storage. Scrap wheels, after being dismounted, are elevated by power to an inclined rail conveyor and rolled directly to the scrap car. Construction and use of the truck is clearly shown in the illustrations. Since being originally designed, it has been improved in certain particulars including the application of rubber-tire main wheels.

Referring to the illustrations, it will be noted that the truck consists of a welded 1-in. tubular steel frame with 53-in. double handle and equipped at the lower end with bearings for two 10-in. main wheels, two 4-in. caster wheels on the outer end and one 4-in. swivel wheel at the heel of the truck frame. The large truck wheels are roller-bearing equipped, have a tread width of 3 in. and a load capacity of 750 lb. The other wheels also have roller bearings, but their tread width is 1½ in. and they have a load capacity of only 300 lb. The width overall of the truck wheels is 21 in. Obviously, the spacing of these wheels is important. The small front wheels, spaced about 18 in. apart on centers, are located 7¾ in. ahead of the main wheels and 4½ in. center distance above the shop floor when the single swivel wheel just touches it. The swivel wheel is 13 in. from the main wheels, center to center.

The truck frame includes a normally diagonal face plate. This is made of ¼ in. steel plate suitably braced to the frame below it. Projecting out at right angles to the face plate is a semi-cylindrical mandrel of ¼-in. plate 5½ in. in diameter and 8 in. long. At the face-plate end this mandrel is welded to a 1-in. by 1-in. bar curved to fit inside the mandrel and extending 23 deg. beyond its edge on each side. This provides a bearing against the face plate. The attachment of the mandrel to the plate permits considerable adjustment of its vertical position to accommodate wheels of different diameters.



Upper left: Carriage tilted up and the mandrel being inserted into the bore of the wheel hub—Right: Carriage drawn back to normal position with mandrel holding the wheel in position on the carrying plate—Lower left: Tilting the carriage to discharge the wheel—Right: Withdrawing the mandrel

A lug extends back from the base of the mandrel through a slot in the face plate and between parallel bars on the back of the plate to which it is secured by a pin through the lug and one of seven sets of holes in the bars.

The mandrel is intended to fit into the upper half of the car-wheel bore. In operation it is tilted forward and inserted in the bore of the wheel hub as it rests against the other wheels. Downward pressure on the handle first raises the car wheel and then, as the face plate is tilted backward, transfers the weight against it and thence to the two large wheels and the small swivel wheel. In this position the car wheel may be moved anywhere on a hard smooth platform or shop floor. On reaching the boring mill or wheel press in the shop reverse operation of the truck tips the car wheel against a shop post or group of other wheels.

Coupler Welding Jig

In the welding jig illustrated the coupled head is held by a clamping arrangement. The shank passes through a square hole in a circular steel plate supported on four rollers in a welded steel frame which, itself, revolves on

The coupler welding jig

trunnions in the main frame of the device. This permits revolving the coupler to any desired angular position in either of two planes and holding it there (in one case by friction and in the other by a locking pin) while welding is being done in the most convenient, down-hand position by the welder.

Some question has arisen, however, as to whether any type of welding jig is necessary or desirable in reclaiming couplers by the welding process. In the first place, the jig will in numerous instances cover up or make it difficult to reach cracks in certain locations at the junction of coupler head and shank. Then the time required to insert the coupler in the jig and remove it again can be more profitably spent in actual welding, according to some shop supervisors, since it is relatively easy for one man to move or adjust a coupler to any desired position

Welding a crack in the head

Building-up a worn slot in shank

on the shop floor, whereas more manpower, or a jib crane, is required to lift a coupler and insert it in the welding jig. What is the answer? The *Railway Mechanical Engineer* will appreciate receiving comments on this subject for publication.

IN THE BACK SHOP AND ENGINEHOUSE

Application of

Tubes and Flues*

New data on the advantages and disadvantages of copper ferrules—Two methods of flue application presented

THERE are still a number of problems of tube and flue application and maintenance for which no definite solution has been found. However, definite progress has been made. The old time "bugbear" of the boilermaker, leaking tubes, is practically a thing of the past. Adequate water treatment, improved materials and tools, and better methods of application coupled with good workmanship, have to a large degree eliminated tube leakage.

Modern power has brought new problems not associated with the older classes of locomotives. Of these, cinder cutting of tubes and flues and longitudinal cracking of tubes and flues through the bead at the firebox end are responsible for excessive maintenance costs. However, as these conditions are not universal on all railroads this allows some expectation that there may be certain factors, which if brought into the right perspective, will overcome or at least retard these adverse conditions.

The combined experience of railroads reporting on flue application in 1944 would indicate that the application of copper ferrules was not responsible for the longitudinal cracking of tubes and flues, and that in general this cracking commenced at a considerable lower mileage where the coppers were omitted than it did where they were applied. It is evident that the coppers act either as a conductor of the heat from the bead or convey the cooling effects of the boiler water to the bead. A number of railroads who, as a war-time measure to conserve this much needed copper, eliminated its use for tube and flue application, have found the results obtained very unsatisfactory, and are returning to the use of copper ferrules.

In the opinion of C. E. Bodine, general boiler foreman, Missouri Pacific, "Copper ferrules should be used, judged by the actual fire miles made by locomotives of the same class and in the same territory. Flues applied without copper ferrules start fire cracking around 70,000 miles, flues applied with copper ferrules around 350,000 miles, and very little then. We have had flues run in excess of 600,000 miles with very little fire-cracking when flues were removed. There are just two things that prolong the life of a flue, proper application and water."

Another railroad experimented with a number of locomotives and applied new tube sheets without copper ferrules. "Holes in sheets were reduced in size to compensate for the omission of copper ferrules. Every care was exercised in applying tubes and flues and welding the beads to the tube sheets. These have been in service for the past two years with the following results: On locomotives operating in soft water territories the cracking of flues on straight back tube sheets commenced at 50,000 miles, whereas other engines of the same class operating in the same territory had no signs of longitudinal cracking at 75,000 to 100,000 miles. In the hard water districts there was better success. On straight back tube sheets 75,000 to 85,000 miles have been made without any evidence of cracking, and 100,000 to 150,000 miles on combustion chamber equipped engines. It is too soon to determine whether engines without copper ferrules in hard water districts will equal the mileage of those with copper ferrules before cracking starts, which is approximately 150,000 to 200,000 miles on straight back tube sheets and 200,000 to 300,000 miles on combustion chamber engines.

"This shorter tube life which we experience in soft water territories where there is a silica content in the boiler feed water is true also of firebox sheets. With adequate water treatment in hard water districts the life of the tubes, flues and firebox sheets is from 25 per cent to 50 per cent longer than in the so-called good (soft) water districts."

In contrast to those who have reported unfavorable results from the elimination of copper ferrules, B. C. King, general boiler inspector, Northern Pacific, who presented in 1944 his successful experiences over a lengthy period of applying tubes and flues without copper ferrules, further substantiates his claim as follows. "In 1934, we had 10 new locomotives with tubes and flues applied with copper ferrules. Flues were removed at an average of 381,429 miles. In 1941, we had eight new locomotives with tubes and flues applied without copper ferrules. Flues were removed at an average of 456,222 miles. As stated in previous reports, we do not use any copper ferrules on the entire railway and run our flues and tubes the full four years service, unless changed for business reasons. In order to use flues and tubes successfully without the use of copper ferrules, the condition of the water must be kept in good favorable condition. Approximately 70 per cent of the water used for locomotive purposes is treated by the wayside method; 28 per cent by lime-soda sodium aluminate treatment, and 2 per cent by zeolite. We do not consider either lime-soda or zeolite methods as complete treatment and have found it necessary to add chemicals as after treatment. In practically every case a mixture of organic chemicals is added to prevent scale formation caused by precipitation in branch pipes, injectors, or feed water heaters as well as to eliminate corrosion tendencies and add coagulation of suspended solids in the boilers. In some cases it has been found necessary to include a form of phosphate with the organics. The development of a synthetic organic, which prevents deposition of phosphates in injectors or other locomotive facilities, makes it possible to add the phosphate continuously to the boilers.

* Report prepared for the 1945 year book of the Master Boiler Makers' Association.

"An essential part of the above treatment is the use of chemicals for the purpose of maintaining an alkalinity-dissolved solids ratio much less than hitherto thought possible or desirable. At zeolite plants sufficient raw water is bypassed to prevent too low an alkalinity. In any case, organics are then added and if silica exceeds ½ grain per gallon, phosphates are added with the organics.

"Our success has been entirely due to the proper water treatment, but our method of application should be followed as closely as shop arrangements will permit."

Applying Flues in One Operation

C. E. Bodine, a member of this committee, describes the successful method of flue application adopted by the railroad he represents, in which flues are flared, rolled and prossered by one operation. "All sizes of superheater flues used on our railroad have been applied by use of the three-way flue roller, Fig. 1, during the past

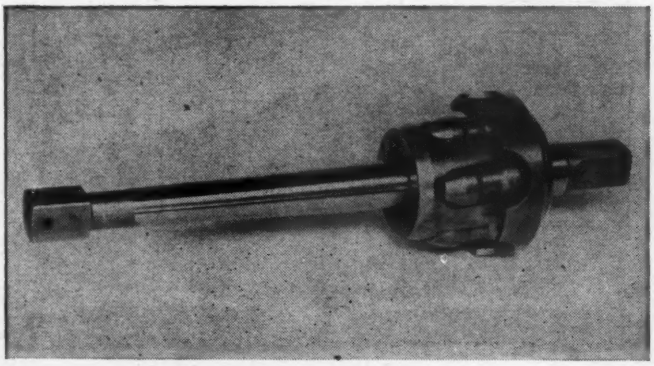


Fig. 1—Three-way flue roller

5 years. This roller is designed to expand flue on water side, roll tube tight in flue sheet, and bell flue for beading, all in one operation. We are using the roller in the front tube sheet, similar to the firebox operation, and have found through experience that the power required to roll large superheater flues tight in front tube sheet is less than with the old original straight rollers, and the tube sheet is not distorted due to excessive heavy rolling required to make tubes tight. All of our superheater flues with 4-in. and 4½-in. ends in firebox tube sheet are rolled from the smokebox end of boiler by the use of a 1½-in. double strength pipe shaft of suitable length with mandrel attached as shown in Fig. 2. As it is necessary to swing the motor to roll tubes in front tube sheet, this same setting is used to roll tubes in the back tube sheet by use of long shaft, and the job is completed in one setting of the motor.

"We all realize the difficulty and the hazard of trying to handle an air motor in the firebox powerful enough to roll the large tubes tight in the sheet with a restricted position. The 3-in. and 3½-in. flues can be worked successfully direct in firebox, eliminating the use of shaft, by the use of a lighter weight air motor. However, this method is optional.

"By using the three-way roller the operation is uniform and avoids distortion of the tubes. Other advantages are longer life, greater mileage, less leaks and fire cracks of flue beads, less enginehouse maintenance and application, and greatly reduced labor cost in applying. On our heavy passenger and freight power, we are getting as much as 400,000 miles between flue settings. We have also found that rerolling tubes with the roller tends to destroy scale on water side of tube sheet, and this is superior to other methods of removing scale. This method of flue application not only eliminates the hazards and difficulties of using a large motor in firebox, but also reduces the man hours required to perform this work as shown in the table."

Applying Flues with Special Tips

By V. R. Bachini

As I have been asked to prepare a paper regarding my flue tips, I shall gladly give the information to describe the principle of the flue connection, my experience with results obtained, and tests conducted.

Several methods of applying the 5½-in. Bachini superheater flues have been tested on the Great Northern and all give very satisfactory service. The principle of the flue bead provides means for the entrance of water between the flue and flue-sheet hole; therefore, the entire surface of the flue and flue-bead connection, including the weld deposit, that is exposed to the hot gases and cold blasts of air is protected by direct contact of water which reduces thermal stress in the bead and adjacent portion of the flue. The weld connecting the flue bead to flue sheet forms an integral joint much stronger than the expanded, rolled, and beaded conventional type flues.*

Man Hours and Labor Costs with Three-Way Roller

Elapsed time for rolling 45 flues in back tube sheet with a three-way flue roller				1 hr. 5 min.
Elapsed time for rolling 45 flues in front tube sheet, from time roller put in first hole and taken from last				30 min
Labor:				
Boilermaker	1 hr. 54 min.	at	$1.05 per hr.	$2.05
Boilermaker's helper	3 hr. 48 min.	at	.79 per hr.	2.99
Boilermaker	30 min.	at	1.05 per hr.	.53
Boilermaker's helper	30 min.	at	.79 per hr.	.40
Boilermaker's helper for preparation	2 hr.	at	.79 per hr.	1.58
Total cost less beading				$7.55

Fig. 3 (a) shows the method used by the Illinois Central in applying the flue tips in one of their locomotives in July, 1945. The same method is being used on the Great Northern, except that the bead projects into firebox approximately ⅛ in. to $^{3}/_{16}$ in. less; i. e., the bead is set a little further into the flue-sheet hole. One general method of applying the flues by arc welding will be given in the following instructions and illustrated in the accompanying drawings.

Welding Tips to Flues

The flue tips as they come from the manufacturer are cut square at both free ends. As illustrated in Fig. 3 (a), the tips are machined at the end of short limb of bead to form a bevel $^{5}/_{32}$ in. by 45 deg. on the water side of the bead to permit better circulation of water. The outer circumference of bead is machined slightly for finishing purposes and should measure $5^{1}/_{16}$ in. in diameter after machining, and the width of the machining on the bead should extend approximately $^{7}/_{16}$ in. from the end of short limb towards the crown of bead. This provides a clean, finished surface for welding of bead to sheet. And, finally, the end of the tip that is connected to the superheater flue is beveled 45 deg. outside to provide a Vee for the welding deposit.

The firebox end of the superheater flues, as shown in Fig. 3 (b), are swaged down with a gradual slope from 5½-in. outside diameter to $3^{11}/_{32}$-in. inside diameter to correspond with the inside diameter of flue tips, the length of swage being 4 in. to 8 in. However, the swage may be

* Conventional type flues, unless otherwise mentioned, means flues connected to the flue sheet by expanding, rolling, ends beaded over, heads seal welded, and using a copper ferrule.

a step-down type, as shown in Fig. 3 (c), from 5½-in. outside diameter to 4½-in. outside diameter, or 4⅜-in. outside diameter, and then down to $3^{11}/_{32}$-in. inside diameter. This step-down method is practicable where the present swage on the flues is a long cylindrical type. The length of a $3^{11}/_{32}$-in. swage is 4 in., or to suit, to provide for several safe-ends without reswaging. Now, the swaged ends are cleaned for welding, usually with a grinder, sandblast, or buffer. Beveling the swaged end of the flue that joins abutt the flue tip is not necessary due the required weld deposit in one pass. If desired, the welding can be done downhand by the multiple-bead method, starting at the top and depositing the weld in stringer beads downwards, making sure that each previous bead is cleaned of scale before depositing the next over it. This method takes about three or four beads to deposit the required amount of weld. The deposited weld should taper off smooth onto flue bead and flue sheet to give the joint greater flexibility. The best electrodes obtainable of the shielded-arc type for welding mild steel

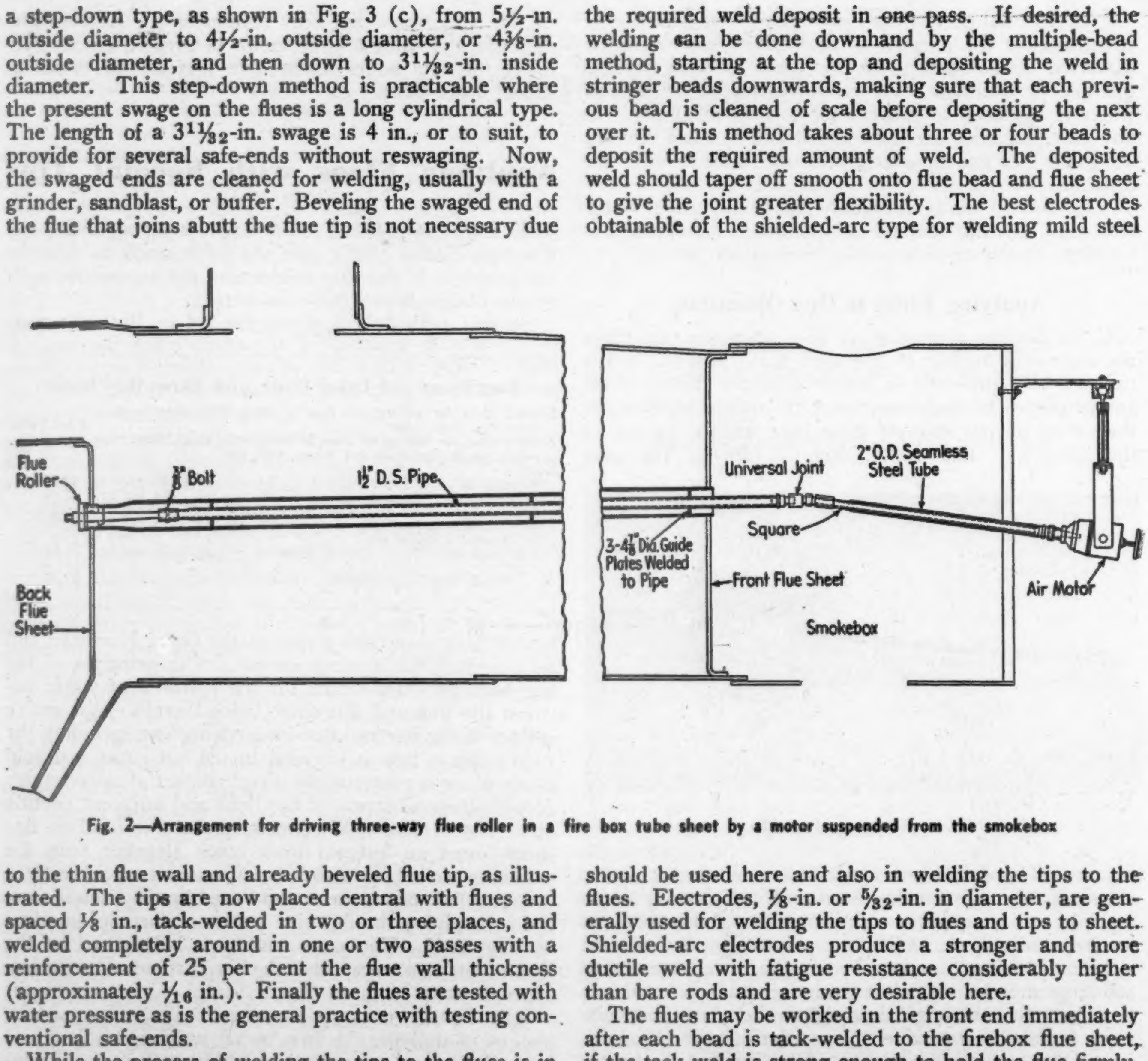


Fig. 2—Arrangement for driving three-way flue roller in a fire box tube sheet by a motor suspended from the smokebox

to the thin flue wall and already beveled flue tip, as illustrated. The tips are now placed central with flues and spaced ⅛ in., tack-welded in two or three places, and welded completely around in one or two passes with a reinforcement of 25 per cent the flue wall thickness (approximately $1/_{16}$ in.). Finally the flues are tested with water pressure as is the general practice with testing conventional safe-ends.

While the process of welding the tips to the flues is in progress, the large holes in the new firebox flue sheet are drilled $5^{3}/_{32}$-in. diameter to allow entrance of the flue tip beads. The face of flue sheet around the large holes should be cleaned of scale or grease. Then the flue sheet and small tubes are installed in the boiler in accordance with general practice and all the small tubes are worked complete. Please note that the only change made to the flue sheets is that the superheater holes are drilled larger.

Welding Beads to Sheet

All the superheater flues are placed in the boiler and each flue tip bead is allowed to project into the firebox approximately $^{45}/_{64}$ in. and the bead is tack-welded to the flue sheet (a channel-shaped gauge can be used for setting the beads). This projection of the bead provides about $1/_{64}$ in. of the bead to remain in the flue hole and thus holds it central. After all the beads are tack welded, any convenient flue is picked out and the process of welding the beads solid to the sheet is started. Skipping around the sheet while welding is recommended; i. e., weld one bead to the sheet complete, skip two, and weld another to produce even expansion of the flue sheet. The welding can be done overhand single complete bead by starting at the bottom and welding up each side to the top, making should be used here and also in welding the tips to the flues. Electrodes, ⅛-in. or $5/_{32}$-in. in diameter, are generally used for welding the tips to flues and tips to sheet. Shielded-arc electrodes produce a stronger and more ductile weld with fatigue resistance considerably higher than bare rods and are very desirable here.

The flues may be worked in the front end immediately after each bead is tack-welded to the firebox flue sheet, if the tack weld is strong enough to hold the flue firmly. Depositing two stringer beads 3 in. long opposite each other are sufficient to hold the flue firmly.

To remove the flues, cut the crown of the bead off with an oxyacetylene torch and chip the weld off flush with the sheet in the same manner as is done in chipping the seal welds off the sheet where conventional flues are installed. The portion of the tip remaining on the flues can be cut off in the flue shop to best advantage.

It is also general practice to apply the flue tips to a boiler without renewing the flue sheet, when the present sheet is still in good condition, by simply reaming the holes to fit the bead.

Tests

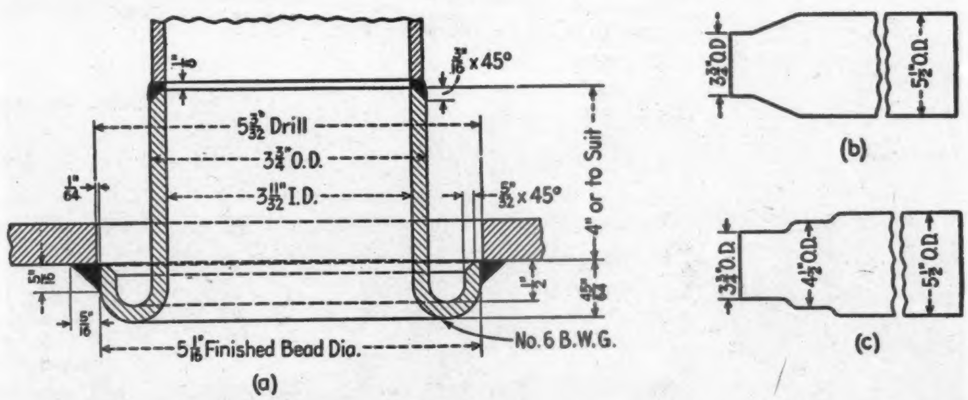
Superheat and evaporation tests have been conducted between locomotives fully equipped with the conventional flues and locomotives fully equipped with the Bachini flues to determine if the reduced diameter of the swage had any effect on the steaming efficiency, but no difference was disclosed. In 1942 the first test locomotive was placed in service on the Great Northern, partly equipped with the special flues and partly equipped with conventional flues, each type grouped separately to give as true a picture of the test as possible. In this test both types of flues were subjected to the same conditions of service

and in three years of testing or approximately 250,000 miles service, it is fairly estimated that the life of the especial flues was over 200 per cent more than the conventional flues and at the end of three years' service the former were still in good condition. In other words, in a period of three years one application of Bachini flues outlasted one full and two partial applications or (retubings) of conventional flues. The Bachini flues were not touched with any sort of tool until the fifteenth month and then an inspection disclosed the small circumferential checks about 1 in. long in the weld, and after the second year of service an inspection disclosed five longitudinal checks. These checks were very small, only one extended through the bead enough to show a stain. All the checks mentioned above were chipped out V-shape and filled in with shielded-arc electrode. Close observation of the welded checks revealed that they could be welded and they did not check over again after welding. The amount of work applied to these flues in this test is hardly worth mentioning, but it is good to know that the checks that did show up could be welded successfully.

In this test as the pressure increased the bead started to flatten out and kept on flattening out until the plug pushed out of the flue. The maximum load was 92,500 lb. The flue sheet dished considerably, but the welding on the flue tip bead was not cracked. The bead flattened down and the inside of the bead was checked circumferentially all the way around.

Test No. 2—Referring to Fig. 4 (a), the load was applied at *B* to push the tip away from the flue sheet to see if the welding holding the flue tip on to the flue sheet would fail. The original height overall of the flue tip bead is about 1 1/16 in. As the load increased, the height overall of the flue tip started increasing until the height overall of the bead measured from 1 9/16 in. to 1 5/8 in. The maximum load reached was 79,800 lb. when the plug welded inside the flue tip against which the load was applied broke around the welded portion. The welding holding the beading of the flue tip to the flue sheet did not show any indications of failure. Examination of the inside of the bead after testing showed it to be checked all the way around and in one place the metal on the

Fig. 3—Method of applying Bachini flue tips and swaging superheater flues to tip size



At the present time, 75 locomotives are fully equipped with Bachini flues, some with over two years' service, and more are being applied. Seventy-five per cent of the flues ordered now are swaged to provide application of the tips.

Specimens of the Bachini flue and conventional flues were tested in the laboratory as follows: Test No. 1—With reference to Fig. 4 (a), the load was applied at *A* to try to pull the tip through the hole in the flue sheet.

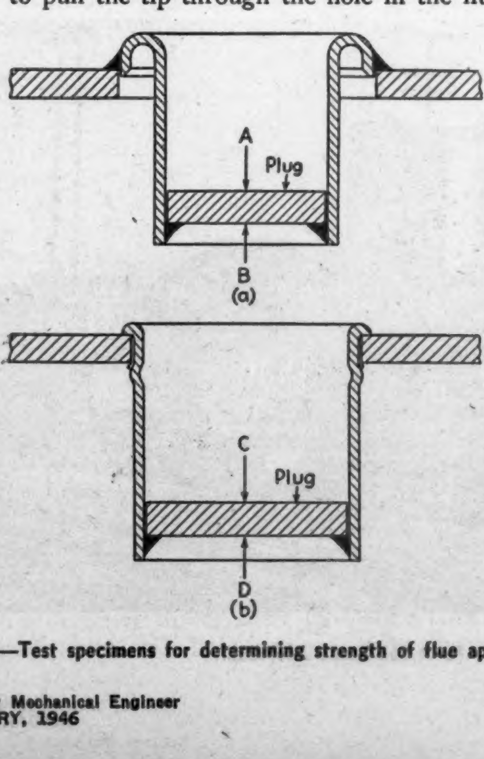


Fig. 4—Test specimens for determining strength of flue applications

inside of the bead was torn about half the way around. The tear, however, did not extend entirely through the body of the bead.

Test No. 3—This test was made on a 4 1/2-in. flue with the use of 1/16-in. copper ferrule and 4 5/8-in. flue-sheet hole. The flue was expanded in the flue hole and then beaded over. The load was applied at *C*, Fig. 4 (b), to try pulling the beaded-over section through the flue-sheet hole. The maximum load was 63,400 lb. As the pressure increased the bead started raising at the outer edges and pulling through the hole in the flue sheet.

Test No. 4—This test was made on a 4 1/2-in. flue expanded and beaded over in the same manner as in Test No. 3. However, the load was applied at *D* and represented the load it would stand in pushing it through the flue-sheet hole and pushing the bead up away from the flue sheet. The maximum load was 30,000 lb.

The Bachini tips can be used to safe-end flues repeatedly, each time using a longer tip to make up for the metal cut away when removing the flues from boiler. After several applications the flue is safe-ended with a 5 1/2-in. diameter tip at the front to provide for a short tip again. However, the flue is reswaged as shown in Figs. 3 (b) or 3 (c), whichever is desired. The number of times that a flue can be safe-ended with tips before applying a front safe-end depends on the amount of flue wasted when cutting flues out, the length of tips first applied, the maximum length of swage, and the method of welding used. Electric-flash, arc, gas, or forge welding methods can be used. However, we have been welding these tips to the flues by the arc and gas methods and have intentions of flash welding them in the future.

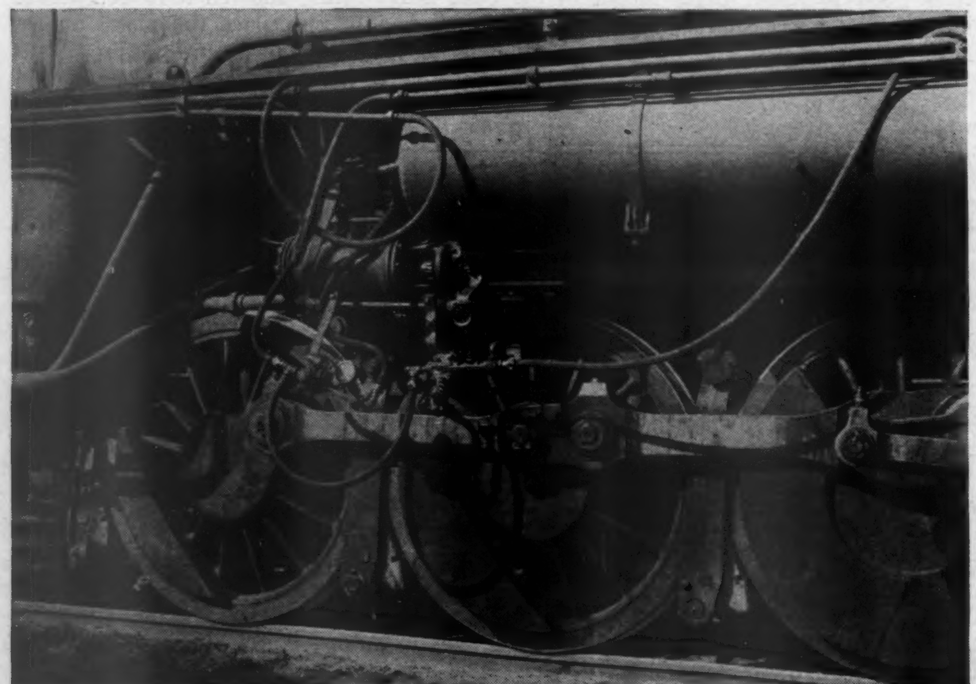
The report was signed by R. W. Barrett (Chairman),

chief boiler inspector, Can. Nat.; I. N. Moseley (Vice-Chairman), master boiler maker, N. & W.; B. C. King, general boiler inspector, No. Pac.; A. D. O'Neal, chief boiler inspector, P. M.; S. G. Longo, assistant general boiler foreman, So. Pac., and C. E. Bodine, general boiler foreman, Mo. Pac.

Lidgerwood Used In Turning Tires

The Lidgerwood machine and special tool-equipped brake heads used in turning worn tires without dropping wheels at the San Bernardino, Calif., shops of the Atchison, Topeka & Santa Fe are shown in the illustrations. This shop is well equipped to turn tires on a modern driving-wheel lathe when locomotives are shopped for classified repairs; but in many cases, due to severe service on mountain grades and curves, excessive tire wear develops ahead of the necessity for repairs to driving boxes, journals, shoes and wedges, etc. Whenever that happens, it is a definite advantage to be able to turn these tires without the delay entailed in dropping wheels at either a backshop or enginehouse. Eight of these Lidgerwood machines are being used at various points on the Santa Fe system.

While a certain amount of skill is obviously required in getting satisfactory results with this method of tire turning, a competent machinist who is familiar with cutting speeds and tools can usually turn tires successfully by this method after being shown how on two or three locomotives. One man is required on each side of the locomotive and there is an operator in the cab of the



Close-up showing air connections and gages used in controlling brake cylinder and cutting tool pressure

Lidgerwood machine used in turning tires on the Santa Fe at San Bernardino, Calif.

Lidgerwood which takes steam from a connection to the locomotives and is moved at a uniform slow speed by winding up a cable suitably anchored at the outer end. It is necessary for the locomotive to be drawn backward so that pull of the tool heads will be down in the normal direction on the brake hangers as tires are being turned. The Lidgerwood operator starts, stops, or varies the speed of the machine in response to signals from the machinist on the ground.

Referring to the illustrations, this arrangement will be indicated. The close-up view shows air connections and gauges used in regulating pressure in the air-brake cylinders which govern the depth of cut of the cutting tools. Approximately six man-hours are required to remove brake heads and substitute special heads which hold the cutting and forming tools, an equal amount of labor being needed to replace brake heads and shoes after the tires are turned. Under normal conditions, tires can be turned on a 4-8-4 type locomotive in about eight hours.

Both roughing and finishing cuts are taken, the tires being calipered and carefully watched during turning to avoid waste of wear metal and assure getting wheels of equal diameter. In cases where one wheel has worn more than the others, the roughing cut will naturally be completed earlier on this wheel and a blind shoe may have to be inserted while other wheels are being turned down to this size. With all wheels rough turned to the same approximate size, the finishing cuts can be made simultaneously using special forming tools and the wheels brought to the same finish diameter within necessary close tolerances which have been set up.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Painting Over Welds

Q.—When painting a locomotive tender on which the seams of the side sheets have been butt welded, is it necessary to prepare the welded areas for painting?—F. I. D.

A.—Where paint is applied over a weld. the slag should be removed, preferably by grinding or sand blasting. Because most of the slags formed by the welding are basic, some of them containing free alkali, it is necessary to scrub the weld and adjacent plate area with water or to neutralize the weld area with a weak acid solution and then wash off the acid solution with water; otherwise, unless alkali-resisting paint is applied the paint will deteriorate through chemical action.

Scarfing Preference

Q.—When applying a patch to the outside corner of the throat sheet, does it make any particular difference whether the patch is scarfed under the wrapper sheet or the wrapper sheet scarfed under the patch?—F. E. R.

A.—The general practice is to scarf the patch under the wrapper sheet seam. Because the patch is being applied to a defective throat sheet it is quite possible that the throat sheet will be renewed before the wrapper sheet. Scarfing the wrapper sheet to fit it under the throat sheet patch could result in an undesirable condition if the wrapper sheet is used again on the outside of a new throat sheet.

Renewing Tube Sheet Portions

Q.—When renewing the bottom portion of the front tube sheet, five rows up from the bottom, due to a cracked knuckle, should the tube sheet be cut out through the tube holes or should the cut be made through solid metal by following the contour of the bridges around the tube holes?—F. E. K.

A.—Both methods are used with good results. When cutting through the tube holes, the cut should be made in a straight line across the tube sheet, the line being drawn through the centers of the fifth row of tubes, not zig-zag cutting the bridges between the tubes in the fifth and sixth rows. The advantage of making the cut through the solid metal by following the contour of the bridges or what is known as a scalloped seam, is the fact that a longer and continuous weld for securing the patch is obtained.

Tube and Flue Lengths

Q.—When applying tubes and flues to an old boiler, where the tube sheets are no longer perfectly flat, should each tube be cut to the correct length over the tube sheets at the location to which it is to be applied?—R. F.

A.—When measuring the distance between tube sheets to obtain the length of tubes or flues the general practice is to take a sufficient number of measurements to insure getting the average length allowing tubes to be ½ in. longer than the average length and the flues ⅝ in. longer. Sufficient material is thus allowed for beading at the back tube sheet and flaring at the front tube sheet. Flues and tubes should be cut accurately to length, and before they are placed in the boiler care should be taken to see that ends are clean and smooth and all scale and burrs removed.

Patch Location

Q.—We have found a pitted area in the bottom of the first course of a locomotive now in the shop. If we apply an inside patch we can use a smaller patch because an outside patch must be large enough to accommodate the renewal of the guide yoke-sheet angle. Are there any objections to placing a diamond-shaped patch on the inside of the shell?—J. E. C.

A.—It would be more desirable to apply the patch on the outside of the shell even though such a patch would have to be larger to accommodate the guide yoke sheet angle. Applying the patch on the outside would permit future inspection of the interior surface of the shell for possible growth of the pitted area, while an inside patch would conceal the defective area. Also, an outside patch would protect the shell in the event the pitted condition extended through the shell course because the edges of the outside patch are readily accessible for caulking.

Lagging Removal

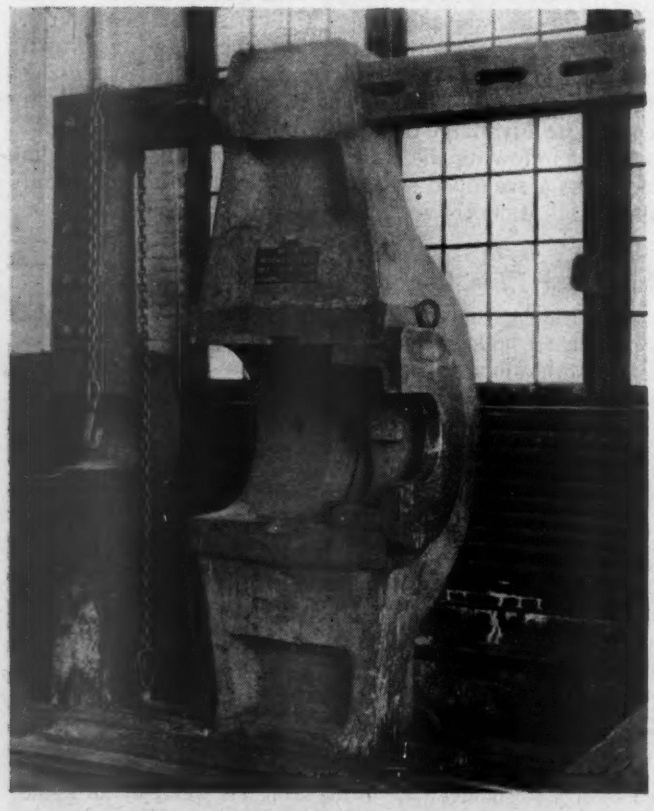
Q.—Is it necessary to remove lagging from the staybolt area of a firebox in order to certify to lagging removal on Annual Locomotive Inspection and Repair Report?—M. S. H.

A.—To comply with Rule 16 of Interstate Commerce Commission Laws, Rules, and Instructions for Inspection and Testing of Steam Locomotives and Tenders, and Other Than Steam Locomotives, the lagging should be removed so that the entire exterior of the boiler can be inspected, which, of course. would include the firebox. In order to certify on the Annual Locomotive Inspection and Repair Report that all lagging was removed, you must comply with Rule 16.

Roller-Bearing Locomotive Repairs

Certain repairs associated with the maintenance of steam locomotives equipped with roller-type main bearings necessitates the use of special shop machinery. The average railway shop is not equipped with a wheel press large enough to accommodate the roller bearings and consequently the wheels have to be shipped to a point, possibly at some distance, where this work can be done.

One of the illustrations shows a Niles 600-ton wheel press equipped with a new resistance head large enough to serve this purpose and also adapted to press wheels on booster trailer axles equipped with driving gears. This particular head was designed to meet the requirements of roller-bearing locomotive wheels on the Wabash.



Resistance head of Niles 600-ton wheel press which is designed to take roller-bearing-equipped driving axles

As compared with the original resistance head of the press, the new head is substantially heavier and, has a larger gap and overhang and hence requires an outer wheel and rail support in addition to the original guide plates and support. The gap in the new head is 28 in. in diameter by 36 in. wide and has the usual cylindrical groove at the center to accommodate an axle stop block when necessary.

When the press is used for non-roller-bearing locomotive wheels, a filler bushing is applied in the resistance head as shown in the illustration, this head also being made of cast steel, with a 9-in. lip extending into the resistance head opening and a 3-in. flange bearing against the resistance head to take the thrust of the press. The opening in this filler bushing is 14 in. wide and the bushing is held in the main resistance head by means of a key bolt extending through both parts and locked by means of a taper key at the back.

Roller-Bearing Box Grinder

Another special machine required in the maintenance of roller-bearing locomotive driving boxes is a grinder for keeping pedestal ways strictly up to standard as regards accuracy and smoothness. These pedestal ways are case-hardened steel and, when worn, require grinding in order to recondition them for further service. Since a tolerance of only .010 in. is the maximum allowable on main boxes and .012 in. on front, intermediate and back, the need of an accurate grinding machine for this purpose is evident.

Motor-driven, vertical-spindle, cup-type grinding wheels, mounted on planer tool heads, have been used for this purpose, but a more powerful grinder application with horizontal spindle, as shown in one of the illustrations, has been developed for use at the Decatur shops of the Wabash. This grinding attachment is applied to one of the tool heads of an 84-in. Niles planer. The 20-in. by 2¼-in. face grinding wheel is mounted on a 3-in. horizontal spindle 32 in. long, sup-

Attachment developed at the Decatur shops of the Wabash for grinding the pedestal ways of roller-bearing boxes

ported in roller bearings with the housing bolted to a vertical plate, 1 in. thick by 15 in. wide by 34 in. high, which carries a 10-hp. induction motor at the top and is itself bolted to the cross-rail head by means of two $1\frac{1}{8}$-in. studs and a bolt through the swivel on the clapper box.

The motor and spindle center lines are spaced 18 in. apart and power is supplied from the motor to the grinding wheel spindle by multiple V-belt drive. Slack in the belt drive is taken up by adjusting the motor position by means of slotted holes in the supporting plate. The motor speed is 1,200 r.p.m. and the use of a 5-in. upper pulley and a 7-in. lower pulley gives a grinding wheel speed of approximately 860 r.p.m.

This grinding attachment is powerful and smooth and can also be used for many other grinding operations. Dependent upon the amount of box wear, a pair of roller bearing boxes can have the pedestal ways trued with this grinding attachment in about 8 hr. When not in use, a bracket on top of the grinder permits lifting it with the shop crane and attaching it to a bracket bolted to the side of the planer frame where it is sttored in an upright position, out of the way and not subject to damage.

Easier Handling and Testing of Air Reservoirs

An excellent example of labor-saving ideas developed as a result of the Employees' Suggestion System on the Illinois Central is the jib crane and test rack installed adjacent to the lye vat at the Memphis, Tenn., shops of this railroad. This suggestion received a suitable award and War Production Board recognition.

Formerly, air reservoirs were taken from the lye vat by a crane truck and placed on the ground in the vicinity of the vat preparatory to being hammer tested. This caused long periods of waiting for a crane truck. After being taken from the lye vat, each reservoir had to be rolled around on the ground so that its entire surface could be tested by hammering, and this operation presented a possibility of injury from the rolling reservoirs. Following this, the reservoirs received a hydrostatic test, and the instability of the reservoir on the ground made it unhandy in connecting and disconnecting equipment and in applying the test.

The adoption of the suggestion mentioned eliminated these inconveniences. A jib crane and trolley hoist were erected to swing out over the lye vat. After being taken from the vat the reservoir is placed on a specially constructed roller table or rack where it is hammer tested.

Former method of hammer-testing air reservoirs on the ground

Jib-crane used in removing air-reservoirs from the lye vat to the roller type inspection table

Electrical Section Reports

Technical committees study effects of electrolysis, wind-driven battery chargers, de-icing coal chutes, new types of motors, and lighting developments—Wire crossing standards are completed

THE 1945 reports of the Electrical Section, Engineering Division, A. A. R., were reviewed in New York by the Section's Committee of Direction on December 5, and plans laid for Section activities during the coming year.

Membership of the Committee of Direction is as follows: J. E. Gardner, electrical engineer, Chicago, Burlington & Quincy, Chicago; R. Beeuwkes, electrical engineer, Chicago, Milwaukee, St. Paul & Pacific, Seattle, Wash.; S. R. Negley, electrical engineer, Reading, Philadelphia, Pa.; D. B. Thompson, mechanical and electrical engineer, New York Central System, New York; K. H. Gordon, assistant electrical engineer, Pennsylvania, Philadelphia, Pa.; Paul Lebenbaum, electrical engineer, Southern Pacific, San Francisco, Calif.; J. M. Trissal, superintendent communication and electrical engineer, Illinois Central System, Chicago; H. F. Brown, assistant electrical engineer, New York, New Haven & Hartford, New Haven, Conn.; C. A. Williamson, electrical engineer, Texas & New Orleans, Houston, Texas.

Subjects reported on were Power Supply, Electrolysis, Overhead Transmission Line and Catenary Construction, Electric Heating and Welding, Motors, and Illumination. Abstracts and summaries of the reports are included in the following:

The Illinois Central has made three installations of windmill battery chargers for the operation of highway crossing protection at outlying locations where commercial power is not available. One of these installations is in Iowa and two are in Illinois. The installations are at crossings where the protection consists of flashing light signals, formerly operated on primary batteries.

The changeover consisted of the installation of a standard 12-volt windcharger with a maximum charge of approximately 7 amp. in a wind of 20 m.p.h. The windmill was mounted on a standard steel signal pole.

A reverse-current relay and ammeter are included in the equipment as furnished. The transfer relay is a 670-ohm relay operated with a 500-ohm resistance unit in series with it. The pick-up voltage is 9.10 volts and the release voltage is 5.59 volts across the relay coil and resistance.

The storage battery is five cells, is rated at 160 ampere-hours, and the standby primary battery is 18 cells to insure that its voltage will be approximately the same as that of the storage battery when charged. If for any reason the storage battery should become exhausted to a point where it would no longer properly operate the signals, the heavy load would reduce the voltage to the release value of the transfer relay which would then cut in the primary operating battery.

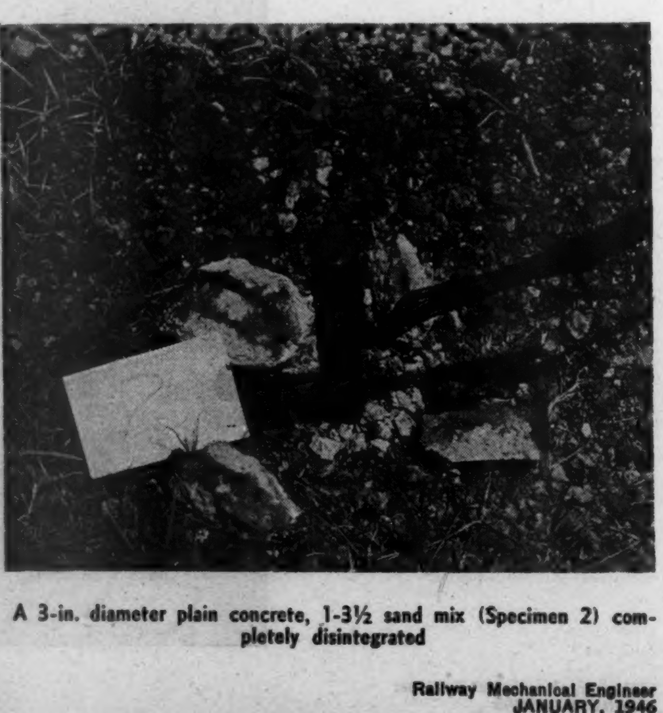
The installation of a recording ammeter has shown that the estimated charging rate is approximately 1.5 amp. during the time that the wind is blowing, which is sufficient to keep the battery fully charged. The performance has been entirely satisfactory; the cost of operating with the windcharger as compared with the cost of operating exclusively on primary batteries indicates an estimated annual average saving for each of the three installations of approximately $65.

The report is signed by C. F. Trueax (chairman), assistant electrical engineer, Illinois Central System; S. D. Kutner (vice-chairman), assistant engineer, New York Central System; R. Beeuwkes, electrical engineer, Chicago, Milwaukee, St. Paul & Pacific; H. F. Brown, assistant electrical engineer, New York, New Haven & Hartford; H. A. Hudson, signal and electrical superintendent, Southern Railway System; R. J. Needham, mechanical and electrical engineer, Canadian National; and J. A. Shaw, general electrical engineer, Canadian Pacific.

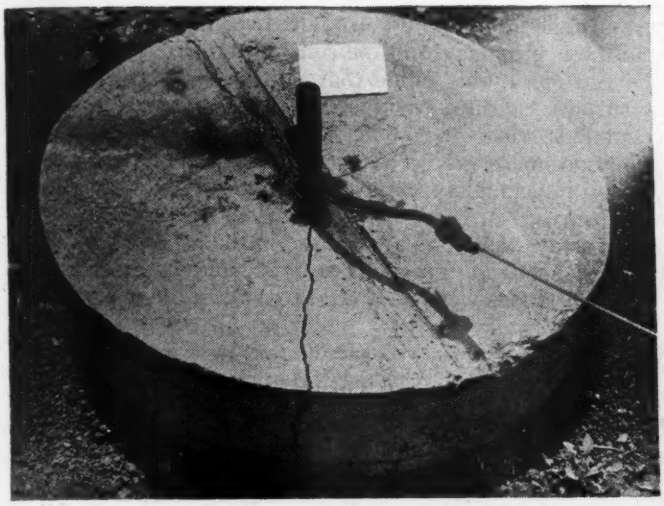
Electrolysis

The study of electrolysis of steel in concrete was assigned to the research staff of the Engineering Division in 1943. Randon Ferguson, electrical engineer, has been in charge of the tests and of preparing the report, under the direction of G. M. Magee, research engineer. The work is being carried on under the general supervision of a special sub-committee of the Committee on Electrolysis of the Electrical Section.

The tests consisted of measuring current flow and noting corrosive effects on one inch round iron rod specimens placed in the ground and subjected to a direct current potential of 25 volts to ground. In a few cases, alternating current was used. The specimens were encased in circular concrete forms of varying diameter. In some cases, admixtures were used in the concrete, and in others, the outside of the concrete cylinder was en-



A 3-in. diameter plain concrete, 1-3½ sand mix (Specimen 2) completely disintegrated



A 25-in. diameter plain concrete, 1-3-5 mix, without covering (Specimen 14), showing radial cracks

cased in an iron pipe or was coated with asphalt. The tests were started June 9, 1944, and on July 16, 1945, the specimens were removed from the ground and examined.

As will be noted from Table I, the amount of current flow at the various specimens was not markedly different except for the specimens with asphalt waterproofing covering which showed a very low flow. There is also apparent a definite trend indicating an increasing resistance and decreasing amount of current flow for all of the specimens, generally, as the test progressed. This may be due to the specimens developing an increased resistance to current flow, as was found in the laboratory test, or to changes in the ground conditions, particularly with respect to the amount of moisture contained.

By July, 1945, it was quite evident that most of the concrete specimens had suffered considerable damage as a result of the electrolytic action. The plain concrete specimens of small diameter had completely broken away from the steel electrodes above ground level. Specimens of larger diameter were still intact but showed well defined cracks radiating outwardly from the electrodes. This was true even in the case of the 25-in. diameter specimens. It was evident that this cracking was due to the expansive force resulting from the electrolytic corrosion of the electrodes.

All of the plain concrete specimens subjected to the direct current potential developed these cracks regardless of the mix or admixture used.

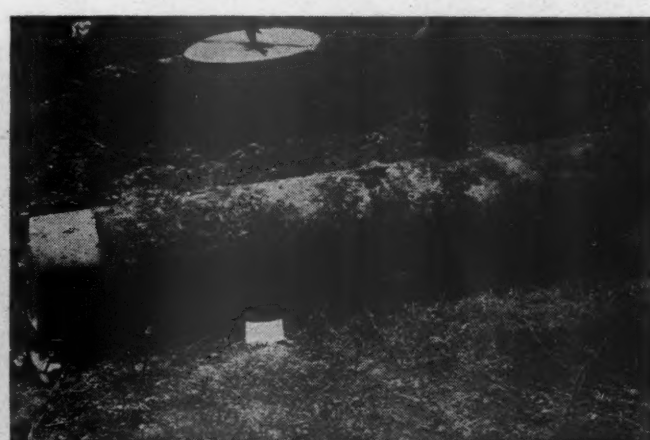
It is apparent that tremendous expansive forces are set up by the electrolytic corrosion of the steel electrode. Not only were the 25-in. diameter plain concrete specimens cracked, but even those specimens encased in the steel pipe developed small cracks radiating from the electrode. However, due to the confining action of the steel casing, these cracks did not open up and become as well defined as in the case of the plain concrete specimens. The lower end of these specimens was not enclosed. To what extent the results would have been different had the specimens been completely encased in steel, including the lower end, is speculative.

Three-inch and 5-in. plain concrete specimens after removal from the ground showing the shortening and tapering of the steel rods

Those specimens with asphalt waterproofing covering appeared to be in perfect condition as did also the specimens which had been subjected to 40-volt, 60-cycle alternating current since September 11, 1944.

It did not appear that anything would be gained by continuing these tests further, and accordingly they were discontinued in July 1945 and the specimens were excavated for inspection. The concrete was almost entirely disintegrated below ground level. This disintegrated concrete could be easily pulverized with the fingers.

The 3-in. and 5-in. diameter plain concrete specimens could not be removed intact and, in general, only a small portion of the concrete adhered to the top portion of the electrode when these specimens were removed. The very substantial shortening of the original 6-ft. steel electrode by the electrolytic corrosion is also quite evident



Left: A 10-in. diameter plain concrete 1-3-5 mix, encased in steel pipe (specimen 20)—Right: The concrete casings around rods subjected to alternating current were not appreciably influenced by the passage of current

in this figure. A very distinctive pointing of the tips of the electrode will also be noted.

In the 13-in. diameter plain concrete specimens about one-half of the concrete remained with the steel electrode when the specimens were removed; and in the case of the 25-in. diameter plain concrete specimens the entire cylinders were removed intact. For these larger diameter specimens, the surface of the concrete generally showed a deteriorated condition and could be very readily broken away and crumbled with the fingers to a depth of ¼ to ½ in. In these larger diameter specimens the concrete were installed. When the asphalt covering was removed from these specimens and the concrete broken away from the electrode, it was found that the steel had maintained its surface condition with absolutely no indication of accumulated rust.

The specimens subjected to the alternating current were removed intact and appeared to be in good condition. The steel electrodes of these specimens when the concrete was broken away, were similar to those in the asphalt-covered specimens, showing no evidence of accumulated rust.

The electrodes were removed from all of the test speci-

Table I—Current Readings—Special Field Test on I. C. Near Twenty-Third Street, Chicago (25 Volts Direct Current Applied Except as Noted)

			Current flow in amperes as of (1944)								
Specimen number	Diameter, in.	Material	June 9	June 19	July 14	Aug. 10	Sept. 11	Nov. 27	Jan. 18	Apr. 23	July 16
1	3	Plain concrete	.66	.52	.54	.18	.19	.66	.23	.68*	.14*
2	3	Plain concrete	.42	.37	.52	.78	.41	.26	.17	.22*	.12*
3	3	Plain concrete	.59	.46	.74	.72	.42	.22	.17	.25*	.16*
4	5	Plain concrete	.48	.39	.42	.30	.36	.89	.50	.51	.16*
5	5	Plain concrete	.48	.36	.36	.34	.32	.38	.19	.76*	.15*
6	5	Plain concrete	.49	.33	.40	.19	.19	.58	.23	.32	.14*
7	9	Plain concrete	.48	.28	.30	.26	.44	.60	.32	.46	.23*
8	9	Plain concrete	.66	.53	.44	.33	.30	.32	.12	.65*	.36*
9	9	Plain concrete	.50	.43	.31	.26	.20	.52	.41	.29*	.27*
10	13	Plain concrete	.47	.28	.26	.19	.19	.21	.09	.20	.11
11	13	Plain concrete	.52	.43	.34	.26	.28	.28	.18	.37*	.29*
12	13	Plain concrete	.44	.32	.22	.15	.13	.14	.06	.12	.10
13	25	Plain concrete	.42	.38	.29	.20	.19	.21	.12	.20	.15*
14	25	Plain concrete	.39	.43	.36	.36	.34	.27	.11	.21	.14*
15	25	Plain concrete	.63	.57	.48	.38	.36	.33	.11	.13*	.11*
16	6	Steel encased	.80	.76	.62	.34	.40	.48	.07	.10	.11*
17	6	Steel encased	.82	.74	.64	.32	.46	.44	.07	.10	.10*
18	6	Steel encased	.87	.85	.61	.32	.51	.53	.07	.08	.10*
19	10	Steel encased	.60	.60	.45	.28	.33	.34	.07	.12	.10*
20	10	Steel encased	.62	.63	.51	.32	.35	.33	.06	.12	.10
21	10	Steel encased	.74	.69	.60	.31	.42	.46	.07	.10	.10*
22	5	Asphalt covered	.09	.04	.07	.07	.10	.008	.002	.003	.004
23	5	Asphalt covered	.011	.008	.006	.004	.006	.005	.001	.002	.003
24	5	Asphalt covered	.064	.004	.002	.002	.003	.005	.001	.001	.003
25	13	Asphalt covered	.21	.23	.22	.21	.17	.045	.010	.032	.024
26	13	Asphalt covered	.28	.044	.032	.020	.028	.026	.005	.021	.017
27	13	Asphalt covered	.13	.012	.009	.007	.010	.014	.005	.007	.008
28	5	PCA mixture	.41	.44	.42	.40	.42	.84	.13	.26*	.18*
29	5	PCA mixture	.48	.34	.30	.32	.22	.38	.20	.43	.16*
30	5	PCA mixture	.41	.28	.19	.18	.16	.50	.23	.22	.12*
32	13	PCA mixture	.65	.48	.50	.25	.44	.37	.15	.68*	.26*
33	13	PCA mixture	.50	.45	.38	.32	.31	.44	.21	.29	.35*
35	13	PCA mixture	.53	.42	.34	.30	.31	.40	.19	.50	.44*
50	5	Celite admixture	.54	.46	.34	.25	.23	.34	.17	.41	.24*
43	13	Celite admixture	.48	.43	.38	.28	.28	.44	.22	.35*	.31*
44	5	Morene admixture	.50	.30	.25	.12	.11	.19	.07	.21*	.17*
46	13	Morene admixture	.45	.36	.22	.18	.17	.20	.06	.14*	.08*
48	5	Hydrated lime admix.	.40	.23	.18	.12	.12	.20	.06	.21*	.18*
45	13	Hydrated lime admix.	.56	.50	.37	.30	.31	.56	.23	.30*	.24*
34	5	A. C. test (40 volts)	..	..	..	..	.40	.53	..	.52	.37
31	13	A. C. test (40 volts)	..	..	..	..	.60	.54	..	.54	.46

* Specimen visibly cracked.

in the center of the steel electrode seemed to be reasonably sound except for the cracks previously described.

There appeared to be no significant difference in the performance of the specimens made with 1-2-3 mix and the 1-3-5 mix.

The specimens encased in steel pipe were removed intact from the ground and the pipe was then cut with an acetylene torch and removed. Electrolytic corrosion of this pipe was clearly evident at the lower end of the specimen. The concrete in these specimens did not show the disintegration that was evident in the uncovered concrete specimens, but the concrete when broken away from the reinforcing rod presented an appearance not characteristic of sound concrete. Also, a well defined layer of rust surrounded the steel electrode having almost a perfectly uniform thickness and being as perfectly finished as if it were a cardboard cylinder surrounding the rod. This rust had a blackish color and also a very fine texture and looked entirely different from the rust that formed on the plain concrete specimens which was similar in appearance to the type of rust that generally forms on steel subject to corrosion from air and water.

The asphalt-covered specimens when removed from the ground appeared to be in as good condition as when they mens, carefully pickled to remove the accumulated rust, and then weighed. Table II is a tabulation of the loss of weight of each electrode as determined by a comparison of the weight of each electrode before it was placed

A 13-in. diameter plain concrete specimen after removal from the ground showing typical disintegration of the concrete at the lower end

in the test specimen with its final weight after the completion of the tests.

It will be noted from this table that the loss of weight for the plain concrete specimens decreased as the thickness of covering increased so that the loss was only about 3 per cent with a 12-in. covering of concrete. The loss was also low with the steel encased specimens, and no measurable loss was found in any of the asphalt covered specimens.

There is some evidence that the rate of loss was reduced with the Morene admixture compared with the plain concrete for specimens of equal diameter.

It was apparent from these tests that aside from the electrolytic corrosion of the steel electrode, which was anticipated, the electrolytic action had also produced a disintegration of the concrete. Accordingly, the Portland Cement Association was invited to have a representative inspect the condition of the specimens, and a report was made by Dr. L. S. Brown in which he described the examination which he made and gives his opinion of the cause of the concrete disintegration.

Table II—Loss of Weight by Electrolytic Corrosion of Steel Electrodes Used in Special Field Test

(Original weight of electrode—Approx. 16 lb.)

Specimen No.	Diameter, in.	Material	Loss in weight, lb.
1	3	Plain concrete	8.5
2	3	Plain concrete	6.3
3	3	Plain concrete	6.4
4	5	Plain concrete	6.5
5	5	Plain concrete	5.9
6	5	Plain concrete	4.0
7	9	Plain concrete	3.8
8	9	Plain concrete	4.3
9	9	Plain concrete	3.1
10	13	Plain concrete	0.8
11	13	Plain concrete	2.2
12	13	Plain concrete	0.2
13	25	Plain concrete	0.4
14	25	Plain concrete	0.5
15	25	Plain concrete	0.7
16	6	Steel pipe encased	0.5
17	6	Steel pipe encased	0.7
18	6	Steel pipe encased	0.6
19	10	Steel pipe encased	0.7
20	10	Steel pipe encased	0.5
21	10	Steel pipe encased	0.6
22	5	Asphalt covered	0.0
23	5	Asphalt covered	0.0
24	5	Asphalt covered	0.0
25	13	Asphalt covered	0.0
26	13	Asphalt covered	0.0
27	13	Asphalt covered	0.0
28	5	PCA mix	5.0
29	5	PCA mix	5.6
30	5	PCA mix	3.8
32	13	PCA mix	2.8
33	13	PCA mix	2.9
35	13	PCA mix	3.3
50	5	Celite admix.	5.1
43	13	Celite admix.	2.4
44	5	Morene admix.	2.5
46	13	Morene admix.	0.7
48	5	Hydrated lime admix.	2.0
45	13	Hydrated lime admix.	3.6
34	5	A.C. test	0.0
31	13	A.C. test	0.7

In order to further verify the observations of the deterioration of concrete as a result of electrolytic action, it was decided to make tests to determine the physical strength of small concrete beams of a size which could be cut from typical specimens taken from the field test. Accordingly, sufficient portions of four different specimens were obtained, of a size which would permit three 2-in. by 2-in. by 12-in. beams to be cut from each. The specimens selected were a 25-in. diameter plain concrete, a 10-in. diameter with steel pipe encasement, a 13-in. diameter asphalt-covered, and a 13-in. plain concrete subjected to alternating current. Each of the small beams was first broken by bending on a span of 10 in. with two equal loads applied at the third points.

After the test beams were broken in the flexural test, each end was subjected to a compressive test. Here again there was considerable variation in the measured compressive strength due to the small size of the specimens which were necessarily used. In this test as in the flexural test, the specimens cut from the 10-in. steel-encased pipe specimen showed distinctly inferior strength. It may be concluded from these tests that as a result of these conditions to which the various specimens were subjected in the special field test, the interior portions of the concrete from the 25-in. plain concrete specimen, the asphalt-covered specimen and the specimen subjected to alternating current, were not deleteriously affected.

The two 5-in. specimens at the left were protected with asphalt waterproof coating—The two specimens at the right are 5-in. and 13-in. diameter specimens made with hydrated lime admixture

Conclusions

Some additional work is contemplated with other types of specimens. These include specimens made with sulfate resisting cements and also additional steel-encased specimens having the lower end enclosed. However, it is believed that the following conclusions can be drawn from the results of the test to date:

(a) Increasing the thickness of concrete covering around reinforcing steel reduced the rate of electrolytic corrosion but did not effectively eliminate it to prevent cracking of the concrete.

(b) Admixtures included in the test were not effective in controlling electrolytic corrosion.

(c) The presence of the steel covering reduced the rate of electrolytic corrosion, but did not effectively eliminate it, and resulted in some deterioration of the physical strength of the concrete.

(d) The asphalt membrane waterproofing covering of concrete provided an effective means of eliminating electrolytic corrosion of reinforcing steel and deterioration of concrete.

(e) The electric potential maintained between the specimen and the ground resulted in a surface deterioration of the concrete of all uncovered specimens subjected to direct current. The presence of some cinders, especially in the top portion of the sand and clay soil surrounding the specimens, may have been a factor in this deterioration, but this is a soil condition generally encountered near railway tracks.

Examination was also made of a concrete catenary foundation on the Illinois Central where a maximum flow of one to two amperes direct current had been observed during the interval of train passage. The foundations had been in service twenty years and subjected to this current for perhaps 10 per cent of the total time.

While damage to the foundation did not indicate any need of repair, it was evident that the anchor bolts were

Catenary footing near Congress street, Chicago, excavated to show condition of concrete

being subjected to corrosion which is proportional to that found in the test specimens.

The report is signed by A. E. Archambault (chairman), assistant engineer, New York Central; H. P. Wright (vice-chairman), assistant electrical engineer, Baltimore & Ohio; R. Beeuwkes, electrical engineer, Chicago, Milwaukee, St. Paul & Pacific; Paul Lebenbaum, electrical engineer, Southern Pacific; Orris McGinnis, public service engineer, Western Union Telegraph Company; G. K. Shands, electrical foreman, Virginian; J. M. Trissal, superintendent of communication and electrical engineer, Illinois Central System; S. M. Viele, assistant engineer, electrical department, Pennsylvania.

Overhead Transmission Line and Catenary Construction

After many years of work, Committee No. 3 on Overhead Transmission Line and Catenary Construction is ready to submit the work it has done relating to crossings of electric supply lines with the facilities of steam and electrified railways. Principles and practices relating to these crossings and recommended minimum specifications have been prepared. The work has been facilitated by a joint committee with representatives of the Edison Electric Institute and the Electrical, Signal and Communications section of the A. A. R. The committee is now ready to submit its report for rejection or approval of the several associations involved.

The Electrical Section report is signed by K. H. Gordon (chairman), assistant electrical engineer, Pennsylvania; A. B. Costic, electrical engineer, Delaware, Lackawanna & Western; S. W. Law, signal engineer, Northern Pacific; John Leinsenring, electrical superintendent, Illinois Terminal; S. R. Negley, electrical engineer, Reading; H. H. Newman, catenary foreman, Illinois Central System; P. E. Snead, assistant engineer signaling and electrical department, Southern Railway System; Sidney Withington, electrical engineer, New York, New Haven & Hartford.

Electric Heating and Welding

The Committee on Electric Heating and Welding submitted as information a report on open circuit voltage reducing control for welding transformers. Considerable progress has been noted in the development of this type of control for welding transformers. One railroad tested four makes of control and found three of them satisfactory.

In general, this equipment consists of a panel containing a small transformer with its primary connected to the supply line, but having a secondary voltage lower than that of the main welding transformer. A relay of the interlocking type changes the voltage between the work and the electrode holder from the welding voltage to the lower voltage when the arc is broken. Incorporated in the relay is a time delay just sufficient to keep the arc stable.

It is interesting to note that the three satisfactory makes used open circuit voltages in the range of 24 to 33 volts. The fourth make used a voltage of approximately 5 volts. One factor acting as a handicap with the 5-volt equipment, is the greater difficulty in actuating the relays with the lower voltage. This can be readily understood when it is recognized that foreign matter of high resistance is frequently present on the surfaces of the electrode and the work, between which an attempt is being made to establish an arc.

With any of these low voltage controls there is a slight time delay while relays are making the transfer to the full welding voltage. It has been found that the welding operator can readily adjust his operations for this by using a longer time in the drag or wiping motion in starting the arc. This manipulation is to be preferred to a repeated pecking motion. It was found that most men who had welded for many years with the usual equipment were able to learn the manipulation in a comparatively short time.

Preventing Freezing of Coal Chutes

The Committee on Electric Heating and Welding also offers as information a report on the application of electric heat to prevent the freezing of coal in the chutes of wayside coaling stations.

The problem of preventing coal from freezing in the spouts and aprons of outlying coaling stations in severe weather is one which has defied entirely successful solution for a number of years. Various arrangements of stoves and steam heat coils have been used with indifferent results. Experiments with electrical heating were made years ago, but it was not until the development of sturdy,

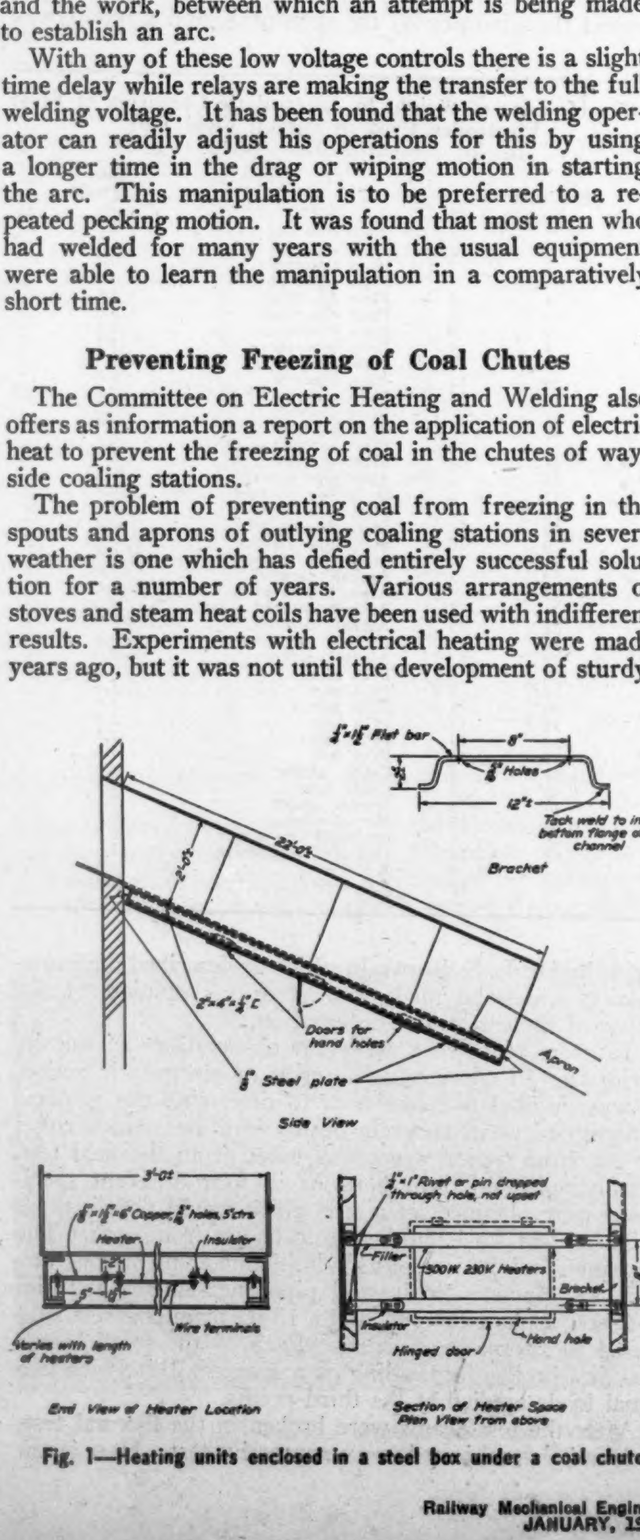


Fig. 1—Heating units enclosed in a steel box under a coal chute

rough service heater units and resistance wire that the method became practical. One installation using strip heaters has been investigated and the following is reported:

The extension spouts are of standard cross section, 2 ft. high and 3 ft. wide and approximately 22 ft. long with the apron. (See Fig. 1.) To form the heater space, one flange of a 2-in. by 4-in. by 22-ft. channel is attached to each outer edge of the bottom of the spout, each channel having its concave side toward the center of the spout. The web of the channel so placed forms a 4-in. vertical extension of the side of the spout and becomes one side wall of the heater space. The bottom of the space is formed by attaching plates to the bottom flanges of the

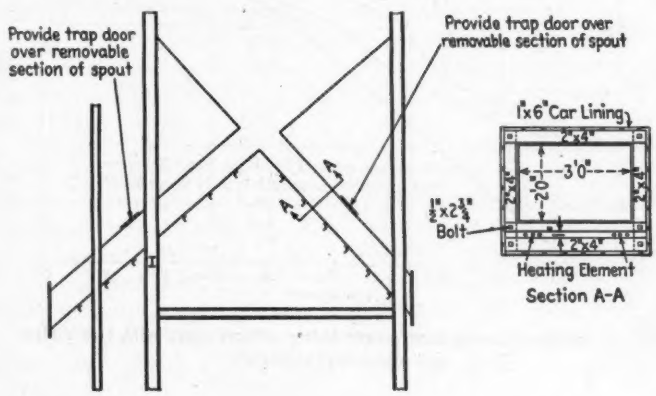


Fig. 2—Heating cable, installation in a chute enclosed in car lining

channels. The inner and outer openings are sealed by boiler plate. At each heater location (three on each spout) a narrow opening nearly the width of the spout is cut and furnished with a hinged steel door. These doors give easy access to the heater units. There is no insulation around the spouts.

At each location two strip heaters are installed, parallel with each other and 8 in. apart, extending from side to side of the spout and with the flat side parallel with the bottom of the space. They are mounted upon saddle brackets, the bases of which are welded to the web sides of the bottom flanges of the channels. The heater strips are only 24 in. long between mounting holes. It is therefore necessary to extend them to 35 in., the distance between opposite brackets. In making up this extension an insulator is cut in on each end. These insulators prevent the development of grounds in case of breakdowns in the units. On the original installation, the assembled units were attached to the brackets by bolts and nuts, but experience showed that excessive corrosion rendered the job of replacement very difficult. Now an ordinary rivet or pin is simply dropped into the connection.

The heater units are rated at 500 watts at 230 volts. They are connected, two in multiple, into six pairs, divided among three phases of a three-phase four-wire delta circuit.

Thermostatic control originally installed was retained until a few years ago. At that time it was found that energy was being used on coal of low moisture content which would not give trouble, even at low temperature. Since that time the heaters have been manually controlled with the addition of a pilot light. This change has resulted in important savings.

Many outlying coal chutes are not attended continuously and in such situations it is necessary to rely on a thermostat and automatic control for protection, even though such control may prove somewhat uneconomical from the standpoint of power consumption.

Another installation investigated involved the use of lead-covered industrial heating cable looped lengthwise on the outside of the bottom of the chute (Fig. 2). The entire chute, including the space occupied by the heater cable, is insulated with 1-in. by 6-in. car lining. Three 120-ft. sections of heater cable are used on each chute and these are controlled by means of two thermostats. At outside temperatures of plus 25 deg. F., one thermostat energizes one section of the heating cable and when the temperature falls to plus 10 deg. F., the other two sections are energized by action of the second thermostat. Each cable represents 800 watts; therefore, in severe weather each chute requires 2.4 kw.

Considerable care must be taken when installing either type of heating elements to insure that the amount of heat is held to the absolute minimum required to prevent freezing, as too much heat causes vapor to arise from coal of high moisture content, which moisture in turn freezes above the protected part of the chute.

Industrial heating cable forms a very convenient method of providing a reasonable amount of heat over a large surface, as any number of cables can be used, depending entirely on the amount of heat required and the length and width of the surface to be heated. Considerable experimenting may be necessary to determine the correct amount of cable which will provide protection with the minimum expenditure of energy.

This cable, No. 19 AWG nickel-chromium conductor, is insulated with felted asbestos and sheathed with lead. The outside finished diameter is 0.245 in. and the cable weighs 198 lb. per M ft. Resistance is 0.5015 ohms per ft. The cable is used in 60-ft. lengths on 115 volts, and 120-ft. lengths on 230 volts. A 60-ft. length represents 400 watts.

The report is signed by C. A. Williamson (chairman), electrical engineer, Texas & New Orleans; J. C. McElree (vice-chairman), electrical engineer, Missouri Pacific; G. K. Shands, electrical foreman, Virginian; A. G. Stradling, superintendent telegraph and signals, Chicago, Indianapolis & Louisville; E. T. Wiltsee, electrical inspector, Illinois Central; R. P. Winton, welding engineer, Norfolk & Western.

Motors

Concerning new developments in motor and control equipment, the report of the Committee on Motors states that during the past year motor manufacturers have been improving the design of their motors. This has been brought about partially by the need for conserving critical materials and through the development of more durable materials. Some changes, such as the use of fabricated bases, instead of cast iron slide rails, have reduced the actual cost of time and material in their manufacture.

When the National Electrical Manufacturers Association frames were originally adopted, the ratings selected gave a temperature rise of about 40 deg. C. Improvements in design, ventilation and insulating materials have reduced the actual rise to values ranging from 15 to 30 deg. C. Therefore, the general tendency of manufacturers is to build more power into a given size. While this is true for open-type motors, it has not been true for totally enclosed motors. In the past, most totally enclosed motors have operated near the maximum permissible temperature rise of 55 deg. C. for class A insulating materials. From the standpoint of the user, it is desirable to have all motors of the same power rating in the same frame size. Some manufacturers are accomplishing this by using a Class B insulation, such as some improved varnishes which, it is said, can withstand 145 deg. C. and in some cases as much as 200 deg. C. without injury.

There are advantages to be obtained by the use of Class B insulation other than the permitting of higher safe operating temperatures. Some of the improved insulations which permit the use of a frame of smaller size for the same power result in a great weight reduction per horsepower. For instance a 10-hp. motor totally enclosed in frame No. 324 weighs approximately 35 lb. per hp., while the same motor using fiber glass insulation can be built in a frame No. 254 and has a weight of approximately 19 lb. per hp.

The tremendous amount of development work in the field of electronic control will undoubtedly have far-reaching effects on post-war industry. Many of the developments at present are not available to the general industry; due to their importance to the war effort, their application has not been publicized. These electronic devices are able to rectify alternating current so that direct current motors can be successfully operated by an alternating current supply with a new wide range of stepless speed control that applies dynamic braking for timed stopping, and change of speed at will while operating. Machine tools, especially grinders, benefit greatly through this method of driving, as the variable speed permits the highest possible cutting speed for the material to be ground, which results in higher cutting efficiencies and steps up production.

Many modern direct-current generating plants with motor-driven stokers, draft fans, etc., operated from the current produced by their plant generator present an excellent opportunity for the application of electronic control as a means of operating vital motors about the boilers when it is necessary to shut down the large generator either because of an emergency or when current is not required for purposes other than operation of the boiler apparatus. They permit the use of a standby alternating current line energized by a central station to be used during an emergency or when it is not economical to operate a large generator for power consumed by a limited electrical load.

Since electronic tubes are able to control the electrons in rectifying current, the possibilities of their use in charging batteries is great. Their dependability, low maintenance cost and flexibility make their use very economical and desirable.

Power Factor Correction

Where alternating current is employed, a condition known as "power factor" frequently enters into the situation, and as the effects of poor power factor are wasteful and otherwise harmful, the subject of power factor correction is important.

Poor power factor is encountered in such circumstances as the use of induction motors, particularly those lightly loaded; transformers; arc and induction electric furnaces; a.c. welding equipment; a.c. electromagnets; long transmission circuits; rotary converters, underexcited, and inductive apparatus of every kind.

Motors operated at above normal voltage rating also cause increasingly poor power factor.

Following are cases where the correction of power factor may prove important:

(a) Where electricity is purchased under a contract providing a penalty for low power factor, a credit for good power factor, or both. In such situations many worthwhile savings can be made by installing power factor corrective apparatus. A study of the different contract rates for current in effect or available will frequently show that large economies can be made by improving power factor conditions.

(b) Overloads on existing generators, transformers, and feeders may often be reduced or wiped out by giving close attention to the power factor of the load involved.

(c) The bringing of low power factor loads closer to unity will also, in many cases, make it unnecessary to install additional feeder cooper or larger transformers.

(d) As an inductive load and its accompanying low power factor increase the amount of current required to

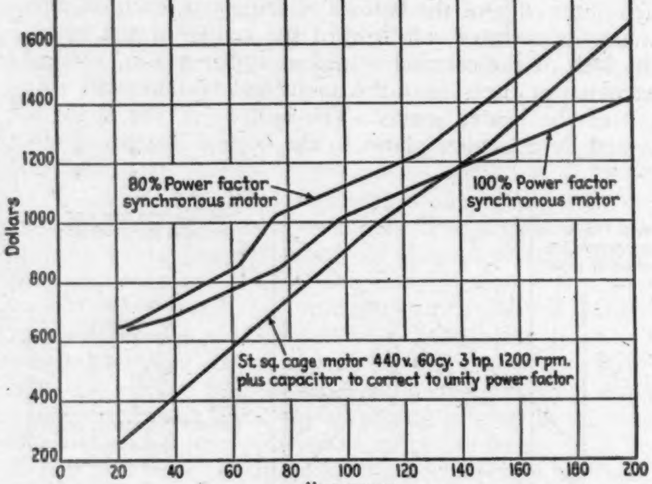


Fig. 3—Graphs showing how power factor affects costs with two different motor arrangements

deliver a given amount of power, such a load tends to cause excessive line drop, low voltage, and low torque in motors, besides interfering with good generator and transformer regulation.

One fact to consider is that too much capacitance in an electric circuit sometimes produces harmful high voltage. Where the inductance varies considerably, automatic switching of capacitors is now economically available to cut out capacitance when not needed for power factor correction. This can also be done manually where regular operators are in attendance.

There are several ways to overcome low power factor. Synchronous motors are well adapted to this purpose.

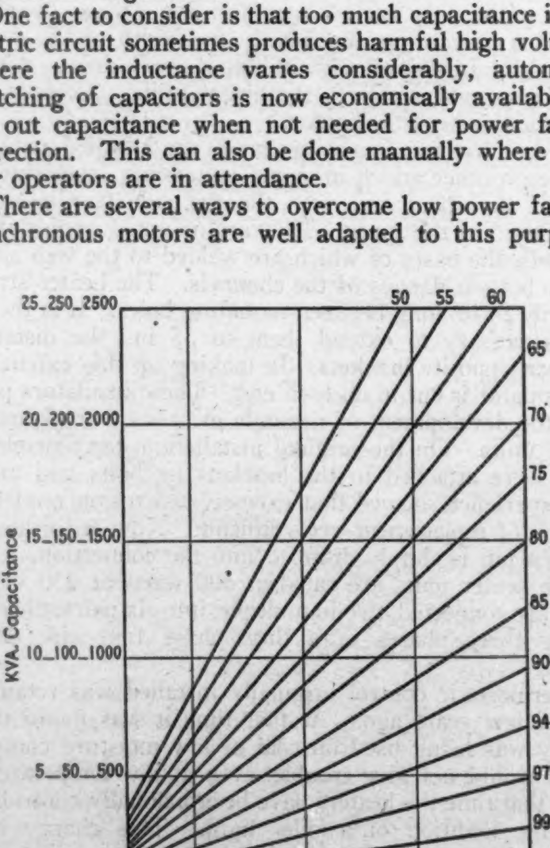


Fig. 4—Capacitance required to correct low power factor

By designing them with overexcitation, power factor correction can be provided for other loads than that connected to the synchronous motor. These motors also have the advantage of providing constant speed for the driven machine, and they are economically available with low speed ratings, particularly in sizes above 75 hp.

Static condensers, or capacitors, afford an easy and economical means of bringing low power factor nearer unity. Such pieces of apparatus require little or no maintenance and have very small operating losses. Synchronous induction motors and rotary condensers are used in this connection, and a systematic plan for the elimination of lightly loaded motors and transformers will help appreciably in a campaign of that kind.

Fig. 3 illustrates differences in the cost of the two most commonly used unity power factor motor arrangements.

Fig. 4 provides an easy graphic method of determining the amount of reactance required to correct to unity or to an intermediate lagging power factor, any given load of any given power factor.

The existing kilowatt load and its corresponding kilowatt-ampere value is determined by test, using for instance, a recording watt-hour meter with a recording ammeter and voltmeter. The kilowatt load (average, or maximum for a given time interval) is taken directly from the wattmeter record; and the product of the simultaneous amperes and volts, corrected for the phases involved, gives the corresponding kilovolt-ampere load. Kilowatts divided by kilovolt-amperes give the power factor.

First find the vertical line corresponding to the kilowatt load, and note where it intercepts the power factor curve. The vertical distance between that point and the horizontal axis is the kilovolt-amperes of reactance necessary to correct to unity power factor. Similar distances along that vertical line give the amounts of reactance required to correct for any intervening power factor. In practice the reactance value obtained would have to be corrected for the efficiency of the apparatus used which would vary from around 83 per cent to 88 per cent for synchronous motors to from 97 per cent to 99.5 per cent for capacitors.

Motors for Machine Tool Drives

There are still many railroad shop tools that are driven by line shafting. Most of these could profitably be equipped with individual motors or special motor drives and thus effect appreciable savings in power in most cases and also insure greater flexibility, increased efficiency of operation, and improved working conditions.

The trend toward individual drives for machine tools has resulted in a demand for a type of motor unit especially adapted to programs of modernizing the older types of machine tools at present driven in groups through line-shafting. Among the advantages to be gained by providing individual motor drives are the following:

Elimination of expensive and complex line-shafting with attendant bearing lubrication and belting problems. Elimination of possible injuries resulting from contacts with shafts and belting.

Savings in floor space made possible by arrangement of the machines independent of the requirements of line-shaft drives.

Increase in the number of available speeds.

Reduction in the number and length of shutdowns due to failure of the power for group driven machines.

Improved lighting made possible by the removal of overhead shafting and belting.

Motors suitable for individual machine drives are made by several motor manufacturers as well as others who produce speed reducers and variable drives.

There is also available a hinged motor base that permits the use of a short belt drive without an idler which automatically tightens the belt as the load increases and slackens it as the load falls off. These motor bases are made in several types for horizontal belts with the base on the floor or platform with the base on the ceiling, or with the base on a side wall. They are also made for use with vertical belts driven either up or down.

Motor drive units consist generally of an adjustable mounting bracket, a shelf for the motor, and a driving pulley having a short belt drive to the pulley on the machine.

The mounting bracket is usually attached to the machine by four cap screws and the motor shelf or base is adjustable for proper alinement and suitable belt tension.

Some units have the motor separate from the gear case and connect with it by means of V-belts or couplings, others have the gears mounted on the machine frame or the motor mounted on the frame of the gear case.

Where a large number of speeds are required, multi-speed motors are used in connection with a gear shift arrangement on the speed reducers. Some units offer infinite speed selection within the maximum and minimum limits of the particular unit applied.

It is possible to make up similar units by using standard geared motors and structural steel mountings, but it is not economical or advisable to do this, as purchased units are made up of castings which are more rigid and cheaper than the specially fabricated units. The standard units are made in sizes up to 25 hp. and are available for lathes, shapers, drills, gear hobbers, milling machines, punch presses, boring mills, planers, grinders, tumbling barrels or rattlers, band saws and power shears.

Motor Protection

Fuses are most commonly used as protection for motors. Time lag fuses are used to a greater extent now than in the past in applications where starting currents are momentarily high. They will protect two and three-phase motors against single-phasing because their long time lag permits them to be of about the same rating as the motors they protect. The increase in current due to single-phasing will open the circuit promptly. The time lag fuses will provide protection against short circuits the same as fuses and act as quickly. At 200-per-cent load they open in 1½ min.; at 500-per-cent load they open in 10 sec.

There are various types of relays having coils in series with the line so as to measure and operate on current flowing to the motor. These relays are usually provided with a dash pot to give an inverse time delay, so that motors will not necessarily be disconnected from the line on very small overloads or on heavy loads of short duration.

It has been found that relays operating on the thermal principle have much better characteristics than dash-pot relays, as they more nearly approach the heating condition obtained in the motor itself under normal conditions. These relays usually consist of a heater installed in series with the motor and transmit heat to a bimetal element which bends with changes of temperature to make or break the contact, as required. Another type of thermal relay employs a low-melting alloy in place of the bimetal element.

Thermal relays allow the motors to be used on overloads safely, since the heating characteristics of the relay are similar to those of the motor. Therefore, it is good practice to locate thermal relays where they will be subjected to the same surrounding temperatures as the motor. Thermal relays installed to protect three-phase motors should be set at not over 15-per-cent overload if the motor is to be adequately protected against operation under single-phase conditions.

A recent trend in motor protection is the placing of the protective device inside the motor, rather than in the starter. This idea has considerable merit as it is the temperature of the motor which determines whether the motor should or should not be taken off the line. There are now motors on the market equipped with a temperature-sensitive device built into the windings and arranged to open the circuit to the motor controlling device whenever the motor attains a critical temperature. Such a device can be used on any motor when the control circuit is not in excess of 250 volts.

The report is signed by A. P. Dunn (chairman), electrical foreman, Michigan Central; J. A. Cooper, electrical engineer, Wabash; C. P. Trueax, assistant electrical engineer, Illinois Central System; A. B. Miller, electrical inspector, Chicago & North Western; G. O. Moores, electrical foreman, Baltimore & Ohio.

Illumination

A specific instance showing the value of good shop lighting has been brought to the attention of the committee. In an electric locomotive repair shop, the light level was raised from a rather spotty 3 to 5 footcandles to a well-distributed 20 footcandles. Comparison of the six months preceding the initiation of the new lighting with the six months immediately following developed the data shown below.

Output of locomotives per day, per cent increase	10
Locomotives returned to shop by inspectors because of poor workmanship, per cent decrease	80
Reportable accidents, per cent decrease	43
Non-reportable accidents, per cent decrease	41

There was no increase or decrease of force during this time. There were no reportable accidents for the last two months of the well-lighted period, and the morale of the workmen has been noticeably improved.

Developments in Electric Lighting

Attention is directed to two new fluorescent lamp types, the "Slimline" and the "Circline." Neither of these lines is as yet complete in all details but the development is believed to be of general interest.

"Slimline" Lamps

Lamp length, in.	Bulb	Watts	Volts	Amp.	Rated lumens	Rated LPW (not including ballast)	Min. starting volts recommended
42	T-6	15	170	0.1	900	60	450
		25	145	0.2	1,400	56	
64	T-6	23	270	0.1	1,400	61	600
		38	230	0.2	2,150	57	
72	T-8	22	245	0.1	1,400	64	600
		38	215	0.2	2,350	62	
96	T-8	30	335	0.1	1,950	65	700
		52	290	0.2	3,300	63	

The lamp lengths shown represent the length over one lamp and two lamp holders.

The color of all lamps is white.

Life ranges from 2,500 hours at three hours burning per start to 6,000 hours at 12 hours per start. These values apply to operation at the 0.2-amp. rate. Life values at 0.1 amp. have not yet been fully established.

These lamps start as cold-cathode but operate as hot-cathode, which accounts for their high light output per unit length of tube as compared with ordinary cold-cathode lamps.

It will be observed that these lamps may be operated at two values of power input and light output, the lower, in each case, being on the order of 60 per cent of the higher.

Salient features of these lamps are:

1—Instant starting.
2—No necessity for starter switches.
3—High light output per watt of power consumed in the lamp proper.
4—Low light output per unit length of tube as compared with hot-cathode lamps.
5—Wide distribution of available light because of the length of tube required to generate it.
6—Small diameter.
7—High surface brightness at full brilliance.
8—Ability to decrease light level and power consumption to approximately 60 per cent of normal.
9—Heavy and cumbersome ballast equipment.
10—Breakage hazard in handling the longer tubes.
11—Relatively large fixtures required, if used, to provide quantities of light comparable with those generated by hot-cathode lamps.

It is probable that these lamps will be employed chiefly in special applications where their characteristics adapt them to the conditions to be met. In planning such an installation, it will be advisable to weigh carefully the characteristics listed above in conjunction with the requirements to be filled.

The "Circline" lamps are fluorescent, hot-cathode lamps made up in the form of a circle. It is proposed to make them in three sizes with outside diameters of 8½, 12 and 16 in. in T-10 (1¼-in.) bulbs, which will permit mounting them concentrically in sets of three. At this time, technical data have been developed on the 12-in. diameter size only. Ballasts, starters, connectors and sockets are in process of development. It is anticipated that these sizes of "Circline" lamps will correspond approximately in characteristics to the 24, 36, and 48-in. straight line lamps.

The field of this type of lamp will no doubt be in special or decorative applications.

Plastics for Lighting Fixtures

The development of suitable plastics for application to lighting installations as light-transmitting media has been retarded by war conditions and your committee is not aware of any such material which is, in all respects, suited to this purpose, all of those available being subject to one or more of the following undesirable features:

1—Dimensional changes under varying atmospheric conditions.
2—Low light transmission.
3—Unsatisfactory behavior under exposure to heat.
4—Change of color with age.
5—Change of pliability with age, resulting in brittleness and a tendency to crack.
6—Warpage under service conditions.
7—Instability of formed shapes.
8—Development and retention of surface static which attracts and holds dirt.

The use of plastics in lighting installations should therefore be approached with caution.

Standard Lamps for Series Burning

The application of standard-voltage, multiple-service lamps to series lighting has been proposed with a view to saving copper. Consideration of this proposal develops the following viewpoints:

1—For service employing the 200-volt class of circuit, the saving of copper by this method over the 3-wire system would not be sufficient to compensate for its disadvantages.
2—For service employing higher voltages, such as 440 or more, the element of hazard to maintainers and others is highly undesirable.
3—Maintenance costs would be increased due to time consumed in determining which lamp of a series had failed.
4—More frequent maintenance would be necessary because failure of one lamp would result in outage of the whole series.
5—Short lamp life would ensue by reason of placing new lamps in series with old ones. Group replacement would be of no assistance in this respect.
6—There are now available other means of providing adequate light with a minimum consumption of copper, such as the use of fluorescent, mercury vapor and sodium lamps.

The committee is of the opinion that this proposal is fundamentally unsound and the use of such a system is not recommended.

Engine-Terminal-Lighting Facilities

The lighting of terminal facilities for steam and Diesel locomotives is under active consideration. The usual method of lighting is by means of pendant reflectors for overhead lighting and angle reflectors mounted from 8 to 14 ft. above the floor for illumination on the sides and running gear of the locomotives. Usually, lamps of inadequate capacity are used and open type reflectors make maintenance difficult.

Several railroads are now experimenting with fluorescent lamps for this purpose. The fixtures, while of the open type, are arranged so as to make maintenance relatively easy and effective. A further report on this subject will be made when more information is available.

The report is signed by E. R. Ale (chairman), foreman, electrical department, Pennsylvania; L. S. Billau (vice-chairman), assistant electrical engineer, Baltimore & Ohio; J. E. Gardner, electrical engineer, Chicago, Burlington & Quincy; H. A. Hudson, signal and electrical superintendent, Southern; S. D. Kutner, assistant engineer, New York Central; R. A. Mylius, assistant electrical engineer, Virginian; G. L. Sealey, assistant electrical engineer, Reading; C. A. Williamson, electrical engineer, Texas & New Orleans.

Communications Test Employs Film Recorder

The Reading has started tests at its Wayne Junction, Pa., yard of a new integrated very high-frequency railroad radio communication system, embodying several novel features.

Two-way conversations were conducted between the main station in the Wayne Junction yardmaster's office and three Diesel-electric locomotives moving about the yard. Messages were exchanged between locomotives, and to and from remote control points in the Wayne Junction trainmaster's office and in the Nicetown Junction yardmaster's office, crews reporting on yard work being performed.

Loud speakers of a type built during the war for action stations on battleships are part of the receiving equipment at both fixed and mobile stations.

The Wayne Junction yard was chosen for the tests because of the difficulties that it presents for radio. The yard area, with its maze of catenary structures, steel buildings and tracks converging at various elevations, introduces many obstacles.

The fixed station is a 25-watt transmitter in the Wayne Junction yardmaster's office. This is connected by wire with the Wayne Junction trainmaster's office across some trackage and with the yardmaster's office at Nicetown Junction, the next station to the north. From any of the three offices it is possible to talk back and forth with crews of the Diesel-electric locomotives that have been equipped with 15-watt battery-powered transmitters. Three locomotives have transmitting equipment and it is being installed in two others.

Messages Recorded on Film

A novel feature of the system is the use of an automatic film type recorder for recording two-way conversations. The recorder utilizes a voice-actuated relay for starting the mechanism and embosses an acetate film that can be filed and replayed as required. This serves as a check on the use and contributes to efficiency of the system.

The recording procedure is similar to that of the usual disc recorder, except that sound grooves are embossed in parallel lines on a 50-ft. film rather than a disc. The film itself is of non-combustible cellulose acetate and, having no emulsion, does not deteriorate with age nor require any processing. Thus, the film can be played back immediately after it is recorded.

The film records a total of 115 parallel sound tracks the full length of the fifty-foot strip which is spliced to form one continuous loop, providing long recording time. The voice-actuated relay feature which automatically starts and stops the machine further extends the recording time to many hours and even days of intermittent recording on the one film.

Through a switching mechanism, the recording and playback needles on the machine automatically move across the film upon completion of each sound track. As the track is completed, the tracking indicator moves ahead one number, indexing the track. This index makes it possible to locate any of the 115 sound tracks on the film, should it be desired to play back any particular portion. Known as the Recordgraph, the recorder unit is manufactured by Frederick Hart & Co., Inc., New York.

The 25-watt transmitter and receiver in the Wayne Junction yardmaster's office—The recorder unit is in the recessed panel—With the unit are (right) Russell Maguire, president, and (left) Nelson Wells, Engineer, Maguire Industries, Inc.

L. A. Moll, Reading electronics and communications engineer, who has been investigating the application of radio to railroads for several years and Maguire engineers who devised the equipment and supervised its installation will direct the tests which are scheduled to continue for three months.

Spray Booth And Canopy Lighting

*By W. H. Kahler**

Spray-booth or spray canopy lighting involves three fundamental problems:

1—To make a fire-safe installation.

2—To provide adequate lighting.

3—To make servicing easy and to minimize the cleaning problem.

In recent years lighting engineers have worked extensively with the spray paint equipment manufacturers in an effort to solve all of these problems with practical equipment and at minimum cost. The experience thus obtained is summarized in this article.

Railway car spraying canopy using incandescent concentrators—These dust-tight and vapor-tight luminaires direct high intensive illumination on the cars to be sprayed

The lighting system will not be a fire hazard if the following precautions are observed:

1—Approved vapor-tight luminaires are used.

2—Lighting equipment is mounted flush in the ceiling or walls; or light is directed into the booth from the front.

3—The area is well ventilated by approved means.

4—The installation is inspected by a local inspection authority. Most inspection departments will approve vapor-tight equipment if installed in the manner outlined above.

* Lighting engineer, Westinghouse Electric Corp., Cleveland, Ohio. The author is indebted to the DeVilbiss Company, Toledo, Ohio, for the photograph and much of the detailed information used in preparing this article.

If white is applied over a dark surface, 10-20 footcandles of illumination is satisfactory. If a dark finish is applied over a dark surface, at least 50 footcandles of illumination is required to give sufficient contrast between the finished and unfinished areas. However, most installations must be satisfactory for both high and low contrast painting, so the higher level is recommended.

All harsh shadows should be eliminated by properly locating and directing the luminaires. Fluorescent units are preferred for this purpose.

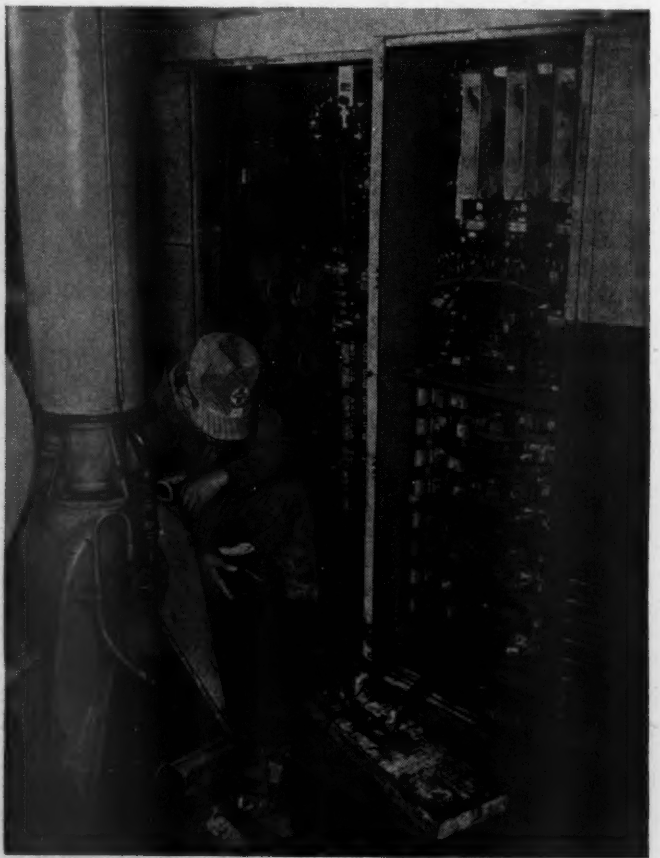
Fluorescent Lighting Has Definite Advantages

Fluorescent lighting has become the predominating type demanded for spray painting because high footcandles can be obtained at minimum wattage, minimum radiant heat improves worker's comfort, long source minimizes shadows, and low brightness cuts down direct and reflected glare.

Vapor tight luminaires should be specified with a heat tempered ¼-in. thick glass cover. Either two or three 40-watt lamp units can be used, but the latter is recommended for most cases, to obtain maximum illumination with a minimum number of units.

Fluorescent luminaires can be installed in several different ways depending upon conditions. The illumination in service depends upon the frequency of cleaning. Paint residue can be easily removed with a cloth if glass panels are coated with a light petroleum jelly. Daily cleaning is recommended.

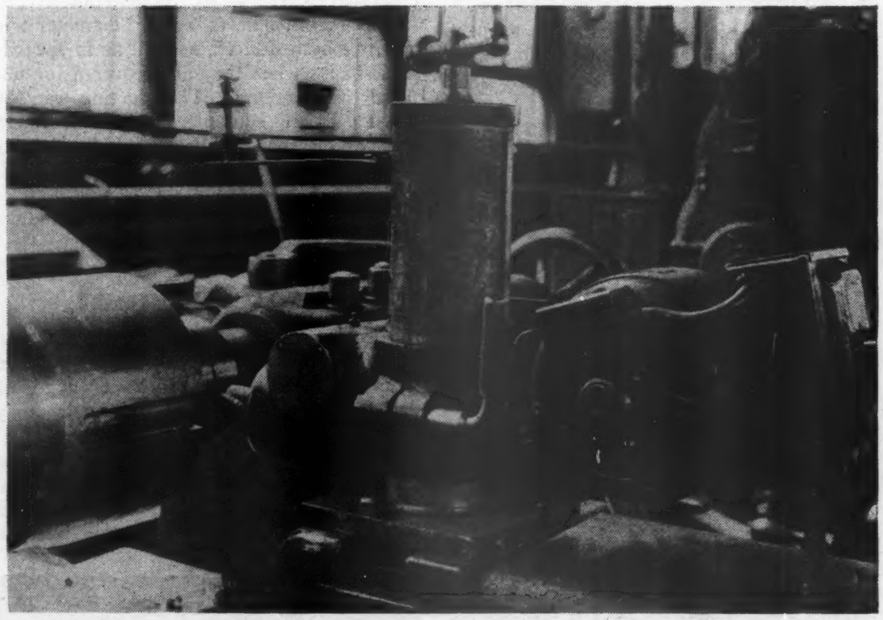
* * *



Load test being conducted on a Diesel locomotive in Winslow, Ariz., shops of Atchison, Topeka & Santa Fe by J. W. Luke, electrical foreman—This hookup, which dissipates generator current through dynamic braking grids in the roof of the Diesel unit, reproduces full-load conditions as encountered on the road—It is used to determine various troubles such as low oil pressure, water leaks, proper loading of main generator and balancing of braking grids

NEW DEVICES

Machining Axle Keyways



The Master lathe converter from the other side showing details of construction and complete keyway

The Master lathe converter shown applied to the tool rest of a large engine lathe at the Decatur, Ill., locomotive shops of the Wabash, is giving eceptionally good service in milling axle keyways and also any other short longitudinal milling operations which can be performed on machine parts without removing them from the lathe. As a matter of fact, the flexibility of the converter is such that, when turned to an angle of 90 deg. with that shown in the illustration, it can be used for milling the keyway in a mounted crank pin by placing the driving wheels close to the operator's position with the crank pin overhanging the lathe carriage at the proper level and the wheels blocked so that light cuts with the end mill can be used to mill the keyway. When machining keyways in main axles, a 1⅝-in., four-tooth spiral end mill is used to cut a keyway 9⁄16-in. deep by 7½-in. long in about 1¼ hr. From 15 to 20 keyways can be cut in the average axle steel before it is necessary to regrind the end mill.

Referring to the illustration, the construction and operation of this Master lathe converter will be apparent. It consists essentially of a 4¾-in. diameter post, 15 in. high, arranged to be bolted to the tool rest and equipped with two semi-circular bearing caps which can be clamped around the post and, when free, raised or lowered by means of an internal screw and the micrometer handle at the top of the post. One half of the bearing cap is expanded into a motor support bearing and the other half is designed to include a worm-gear drive to an end mill or other type of mill which does the cutting. This end mill is held in a taper socket and is threaded on the inner end as there is no room for a taper key in this application.

The 220-volt electric driving motor is rated at ¾ hp. and operates at 1,750 r. p. m., under push-button control from a convenient starting box. Drive from the motor to the worm-gear unit is secured through a single V-belt and two four-step cone pulleys, the largest step size being 6 in. in diameter and the smallest 2 in. An Alemite fitting facilitates easy lubrication of the worm-gear unit and an oil cup, mounted on an extension bracket over the axle supplies lubricant when needed for the milling operation.

In setting up to mill an axle keyway, the converter is lined up, or adjusted accurately at 90 deg. with the lathe centers and the cutter height adjusted to the right level by the top hand screw. The chuck end of the axle is held in a steady rest and the chuck jaws released so that the lathe can be started and turn the drive shaft which revolves a gear against a rack on the underside of the lathe toble and gives the carriage and cutting tool longitudinal feed. The depth of cut is, of course, adjusted by means of the cross-feed screw in the compound tool rest.

Master lathe converter milling keyway in locomotive driving axle at the Decatur shops of the Wabash

Shut-Down for Diesel Engines

Viking Instruments, Inc., Stamford, Conn., is now producing the Viking Type R-18 safety control system for the shut-down of Diesel engines when temperature of the circulating-water system becomes too high, or when there is insufficient lubricating oil pressure. It operates by means of a pressure-responsive unit, connected in the lubricating oil system of the engine, and a thermostatic by-pass valve installed in the circulating water system.

The pressure-responsive unit houses a bellows which expands upon a drop in pressure. This in turn releases a trigger so that a rod and spring operate the fuel pump or governor lever to shut down the engine. This drop in pressure and consequent shut-down of the engine may be caused by failure of the oil supply, or opening of the thermostatic by-pass valve due to increase in circulating-water temperature.

This self-operating system has the inherent advantage of not requiring any electrical power or additional accessories. Consequently, trouble often encountered by

blowing of fuses, burning out of lamps, and electrical power failures, etc., are eliminated. Design and construction is simplified and installation is easily made.

Commutator Slotters

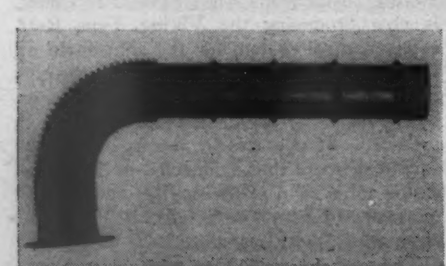
Commutator slotters which will support armatures on centers up to 66 in. long, with commutator diameters ranging from 3 to 18 in., are being made by Electric Service Manufacturing Company, Philadelphia, Pa.

Type SS slotter for large armatures—A similar machine designated as type SSX is available for armatures up to 54 in. in length

A vee roller bearing may be substituted for the center support extending the distance between roller heads to 72 in. The motor-driven saw shaft is supported in a long bearing, which in turn is bolted to the sliding crosshead. Two steel rods, which project over the commutator, support the crosshead. A hand lever is used to operate the crosshead. The supports at both ends of the armature are adjustable vertically, permitting accurate adjustment of the depth of the cut.

Flexible Tubing

A material, created during the war for aircraft heating and ventilating, is now available for other manufacturers as a ducting for hot or cold air. Known by the trade name Airtron, it is made of glass cloth and



Light tubing recommended for use in air-conditioning and ventilating applications

rubber and provides very high insulation qualities as well as great flexibility. The flexibility makes its use desirable where vibration is present, for it will operate indefinitely under conditions where metal ducting develops fatigue cracks. Tests have indicated a use for this product in the heating, ventilating and air-conditioning of future planes, trains, automobiles, buses and homes.

It withstands temperatures from minus 60 deg. F. to plus 300 deg. F. without a change in properties and will stand well over 50 lb. per sq. in. internal pressure at all temperatures. It is unaffected by air, light, water, gasoline, oil and all but concentrated mineral acids. It is manufactured in tubes from 1 in. to 6 in. in diameter and in any length desired, as well as in specialized shapes when they are required for unusual installations. The ducting can be adapted to any equipment as a replacement or as an original installation. It is made by the Arrowhead Rubber Company, 2244 E. 37th Street, Los Angeles 11, Calif.

M. & J. Filter Element

The sock-type filter element, originated and now being marketed by the M. & J. Diesel Locomotive Filter Company, Chicago, is designed as a replacement unit which may be quickly and easily applied in the lubricating oil filters of Diesel locomotives to give superior service in removing foreign matter from the oil, and prevent lint and small pieces of waste from getting into the oil lines, engine cylinders, bearings, oil sump, etc.

The principal advantages claimed for the new filter element include more reliable engine operation with reduced hot bearings, increased mileage between oil changes, less time required to clean and repack oil filters, reduced damage to oil filters and screens since the new filter element slips easily in place and hand-packed waste is not forced into the filter with excessive pressure and often very irregular results. In addition, damage to oil-sump screens is avoided and these screens will require cleaning much less frequently.

Referring to the illustration, the construction of the filter element will be apparent. A 2-in. sheet-metal center tube is 28 in. long and reinforced with ribs to prevent collapsing under oil pressures up to 150 lb. per sq. in. This center tube is perforated with 1/16 in. holes spaced 1/4 in. diagonally around the entire periphery of the tube to insure equal lubricating oil distribution throughout the length of the element. A 2 1/4-in. white knitted cotton tubing or sock, cut 70 to 78 in. in length, is secured to the center tube so as to prevent slipping and has sufficient elasticity to cover 7 lb. of filter material without bursting. This cotton sock is shown in the second view from the left and rolled back to show a section of the metal tubing and of the uniformly packed filtering material in the center view. The complete element is shown next and the lubricating-oil filter in which it is applied, at the right.

The filtering material consists of fine white single-strand spooler threads delinted during the course of machining, thoroughly combed and free of lumpy tangled threads, sizing, shredded rags, synthetic fibre, or other substance foreign to high-grade white cotton thread. Seven pounds of this filtering material with seven per cent maximum moisture content and two per cent maximum oil and dirt are uniformly packed by

Details of construction of the M. & J. filter element used in Diesel engine lubricating oil filter (Right)

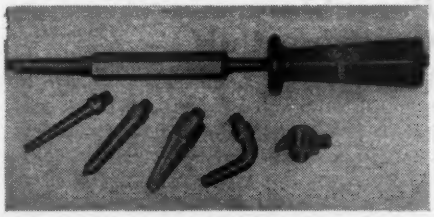
machine in the filter element which has an outside diameter of six inches. This uniform packing contributes to more satisfactory filter operation inasmuch as former hand packing methods not only damage the filter but tend to cause too tight packing and stoppage of oil flow in one part of the filter when possibly another part is too lightly packed and hence does not produce the desired filtering effect. The M. & J. filter element is slightly longer than the filter so that when the cover is applied the element is sealed top and bottom, causing oil to pass through it. The frequency of packing depends upon the number of filters in any particular locomotive, but in any event is much less than formerly required.

Each filter element is used only once and

at the end of its period of service the oil is squeezed out and the waste reclaimed for further use in wiping or journal box packing.

Soldering Iron With Thermostatic Control

A soldering iron with a self-contained thermostatic control is now being offered by the Sound Equipment Corporation, Glendale, Calif. The iron has a long life expectancy because it eliminates excessively high temperature; tips, the maker states, last longer because they are not overheated and consequently need less retinning.



The iron is supplied with six tips one of which is a small tinning pot

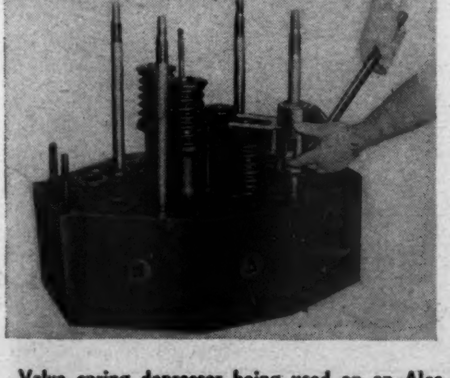
The iron is called Kwikheat because it heats up, ready-to-use, only 90 seconds after plugging in. This is made possible by a 225-watt heating element, held in check by the thermostat.

It has a hard-chrome-plated steel octagonal shell, a plastic handle, and weighs 14 ounces. Six interchangeable tips are available, one tip being an aluminum-alloy melting pot for tinning.

Although the iron has been proved in use for several years by large industrial users, it is now available generally for the first time on a nationwide basis through supply houses.

Diesel-Engine Valve-Spring Depressor

A valve-spring depressor designed for one-man operation in dismintling and assembling Diesel engine valves is now manufactured by the Paxton Diesel Engineering Company of Omaha, Neb. The tool will compress a valve spring to any point and hold it there while leaving a mechanic's hands free to remove the keepers and pin and then proceed with the job. It does not nick the stud and is so designed that the spring can be released safely and simply. Safe-N-Ezy valve spring depressors are available in sizes and models to fit all modern Diesel engines. The tool is ruggedly constructed, of light weight, and is easy to store.



Valve spring depressor being used on an Alco Diesel engine head

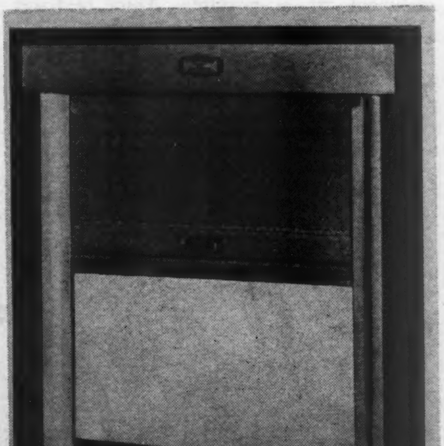
The compression movement and holding functions are effected by tilting sleeves or washers through which the stud passes. A small lever projecting from the side of the body of the tool permits the holding washer to be released.

Pratt Window Curtain

The Pratt passenger-car window-curtain unit, now being marketed by the Power Parts Company, Chicago, is a new curtain design which has been extensively tested under actual service conditions and is furnished complete with plastic or metal window sill and rubber moulding strips in a self-contained frame.

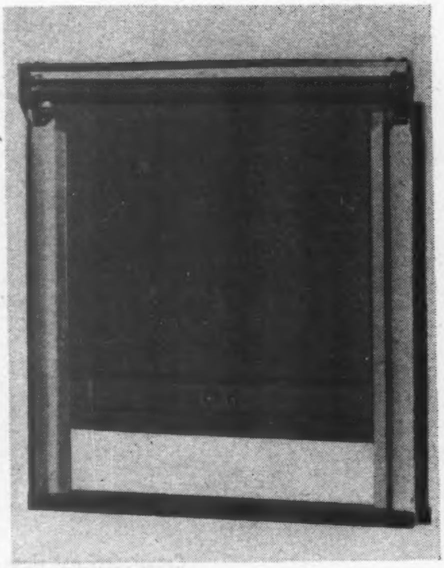
Utility, appearance and ease of installation are major objectives sought in the design of this unit. A variety of shapes and annodized colors are available for the exposed aluminum extruded parts, permitting flexibility in design to harmonize with the styling of any particular car interior. Colors, patterns and styles of curtain material as selected by individual roads will be used.

Important advantages claimed for the new curtain unit are as follows: The curtain remains in any desired position; it can be operated from any point; the bottom bar always remains parallel; the side edges of the curtain cannot run out of channels; the unit is anti-rattle and entirely light-proof. In addition, the curtain is designed to be taut at all times due to a compensating spring connecting the curtain roller and spool shaft which equalizes the tension between the curtain material and the operating tapes as the diameters of the curtain material and the tape spools change.



Front view of Pratt window-curtain unit

The anti-rattle feature of the new Pratt window curtain is secured by means of spring-loaded shoes contained in the sliders attached to both ends of the bottom bar. The bottom bar must stay parallel because both operating tapes, one at each end, are working in unison and are fastened to the bottom bar and pulleys at the top. The curtain extends approximately ¾ in. into the channels at each side, and the addition of bumper pads underneath the bottom bars eliminates passage of all light. The curtain operates from any point and will remain in any desired position because of an equalizing movement which has a counterbalancing action embodied in the design.



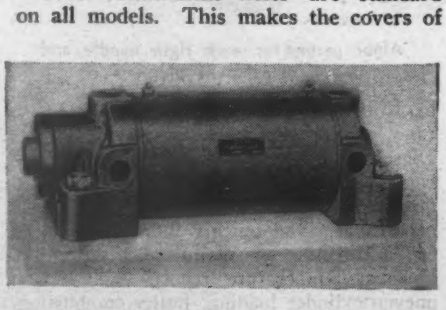
Top roller and operating tapes seen from the rear

Hydraulic Cylinders

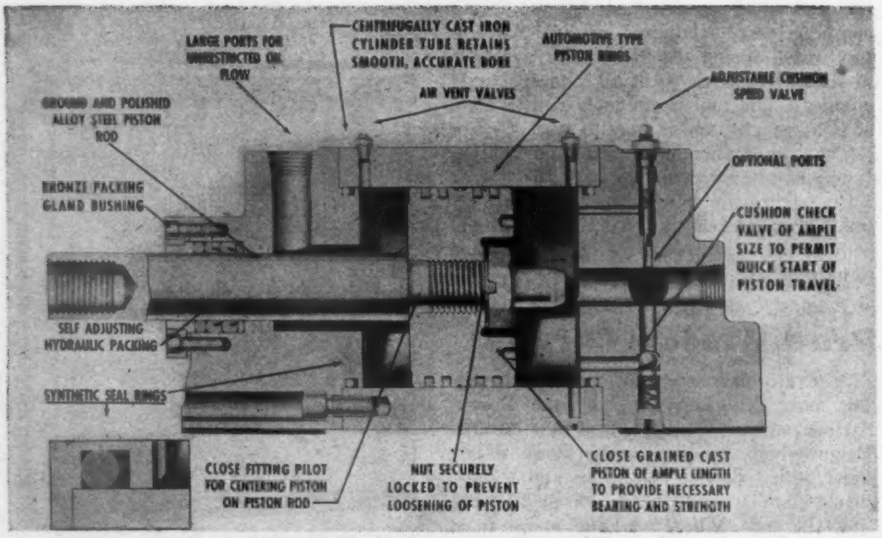
Maximum power without leakage, and lasting accuracy of bore dimensions resulting from centrifugally cast barrels and other features are obtained from the improved Rotocast hydraulic cylinders made by the Logansport Machine Company, Incorporated, Logansport, Ind.

Making efficient use of smooth-operating hydraulic power, the cylinders are adapted for a wide range of operations involving pushing, clamping, lifting, forcing, holding, pulling, pressing and other power movements in any direction. Standard hydraulic cylinders are offered in seven mounting types, three piston-rod models and nine standard bores. They are available with cushioning at one end or both ends as desired. Although designed primarily for oil service, they may be used for water service if the water is treated. If untreated water must be used, cylinders of special material can be supplied. The cylinders are built for operating pressures to 1,500 lb. per sq. in.

Cover attachment holes are standard on all models. This makes the covers of



Foot-mounting type of Rotocast hydraulic cylinder



Cross-sectional view of hydraulic cylinder

the various types completely interchangeable, and permits a wide range of combination mountings such as flange mounting at the rod end with foot mounting at the blind end, etc. Standard mounting types include rabbeted, foot, center-line, clevis, trunnion, flange at the blind end, and flange at the rod end.

Alnor Exhaust Pyrometers

Exhaust temperature readings are a valuable guide to efficient operation, adjustment, and maintenance of Diesel locomotive engines, and new Alnor portable pyrometer equipment, recently placed on the market

Alnor pyrometer with rigid handle and attachment plug

by Illinois Testing Laboratories, Inc., Chicago, makes the recording of locomotive Diesel temperatures a routine operation. Exhaust temperature readings at the time of terminal servicing give a check of engine performance and quickly indicate the need for adjustment or maintenance attention. Exhaust temperature records will reveal uneven cylinder loading, faulty combustion, improper cooling and other evidences and causes of operating troubles.

At engine-overhaul periods, the exhaust temperatures give an easily used guide to maintenance and adjustment and a reliable indication of correct and efficient operation. It is said that traveling maintenance men find the exhaust pyrometer gives an excellent check on engine operation, for engine temperatures show the need for adjustment or maintenance attention in advance of operating troubles.

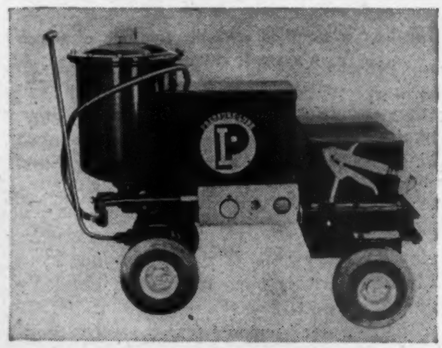
The Alnor Type-T multi-point switch can be conveniently mounted anywhere near the engine and is permanently wired to the thermocouples in the engine exhaust ports. The switch case has a receptable for attachment of a portable Alnor exhaust Pyrometer.

In the case of the Alnor exhaust pyrometer with flexible cable and attachment plug, the pyrometer is held in the hand and the exhaust temperature of each of the cylinder ports is obtained by turning the switch knob. The Alnor pyrometer with rigid handle and attachment plug is plugged into the switch receptacle, thus leaving both hands free to record the temperatures.

This pyrometer equipment is designed for locomotive use. It comprises a simple installation and a convenient means of reading exhaust temperatures at terminals and shops. The indicating instrument is generally not used by enginemen when on the road.

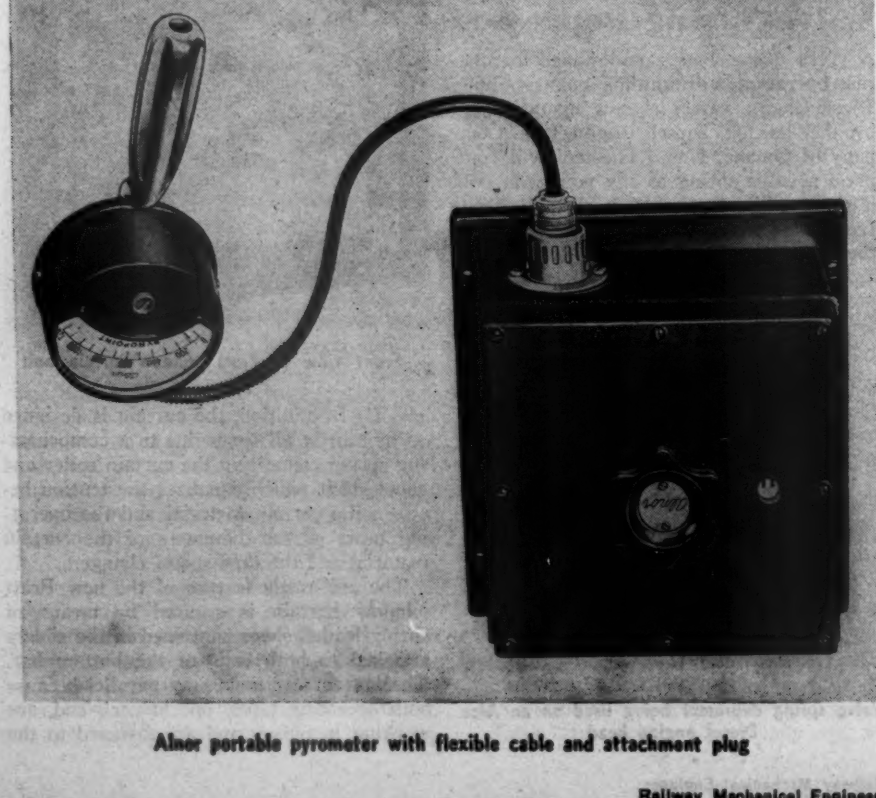
Portable Greasing Unit

Portable greasing equipment which can be supplied with a grease gun for every purpose and is available either with battery-powered or a gasoline-driven motor is manufactured by Pressurelube, Inc., 609 West



A greasing cart with an integral power source

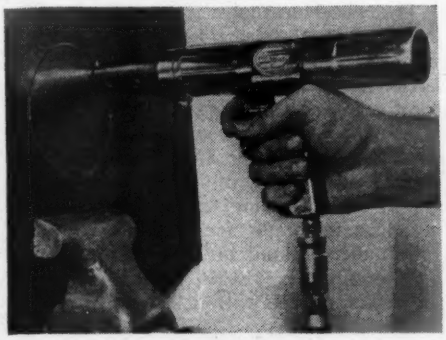
134th street, New York 31. Flexible, economical operation is assured by its complete portability, no electric cord or air hose is required. The unit delivers up to 12,000 lb. steady, consistent pressure which is instantly available to clear channel stoppages and effect complete lubrication of parts.



Alnor portable pyrometer with flexible cable and attachment plug

Pneumatic Air-Speed Saw

Designed to simplify and speed up many sawing and filing operations, the Air-Speed saw and filing tool, distributed by the Air-Speed Tool Company, 1028 West Slauson Avenue, Los Angeles 44, Calif., can be worked advantageously in awkward or cramped quarters or from difficult positions. An adjustable barrel readily permits circular sawing in metals or woods, as well as difficult dead-end, keyhole or scroll work. The tool, driven by compressed air, is balanced for ease of handling and weighs 3½ lb. complete. It features finger-tip



Pneumatic tool for cutting or filing

speed and power control, and a simple cutting-stroke adjustment of from ¼ in. to 1¼ in.

No gears, adaptors or power take-off devices are used in the construction and only two internal operating parts are movable. The saw operates best with approximately 85 lb. pressure maintained at the tool.

Arc-Welding Aid

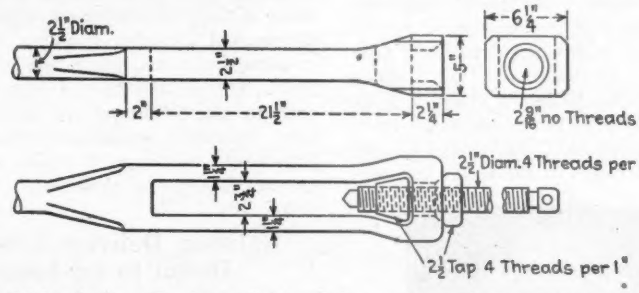
An arc-welding compound designed to aid in instantaneously creating and maintaining a metallic welding arc where low currents and small-diameter electrodes are employed has been announced by the Electric Welding Division of the General Electric Company. Known as Strike-easy, the compound is easily applied and can be used on any kind of metal with any type of electrode. It is in paste form, and is available in one-pound glass jars, ready for use. No mixing or other preparation is required.

Driving Brake Adjusting Rod

A design of a locomotive driving-brake adjusting rod on which a patent has been applied for by James D. Carlin, 821 Linwood avenue, Louisville 4, Ky., is shown in the drawing. The invention is intended to reduce rod failures and the repairs necessary when failures occur to the rods now in general use. The cage end of the brake-adjusting rod has been designed to accommodate a nut, making it possible to eliminate the threads in this end of the rod. Since there are no threads in the end of the cage, a lock nut with a suitable taper has been applied to the screw, for the purpose of preventing unnecessary movement of the screw. The tightening of the lock nut automatically centers the screw with the unthreaded hole, preventing the threads from contacting the metal in the cage end.

An essential feature in the design is that in case of a failure to either the nut or screw the nut can be moved forward ¾ in., which permits the cutting off of the screw between the nut and the inside back end of rod with an acetylene torch.

By having the thread in the nut, instead of in the back end of the rod, a steel can be used which is suitable for both the nut and screw which permits a heat treatment whereby maximum service can be had.



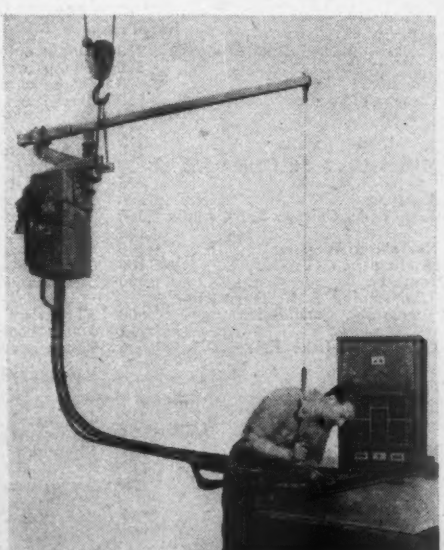
Driving-brake adjusting rod intended to reduce possibility of failures

This design of rod makes it possible to renew the nut and screw without removing the rod from the engine and also eliminates the costly repairs of plugging, re-drilling and tapping, as is the case when a failure takes place in the rods now used. Any type thread can be used and, while the drawing shows a U. S. Standard Vee thread, an Acme, or a square thread could be applied.

Portable Spot Welders

A line of overhead type portable spot-welding units has been announced by Sciaky Bros., Chicago. Both pneumatic and hydraulic systems are available with transformer ratings of 50, 75 and 100 kva.

A variety of standard gun styles in both



Overhead portable spot welding unit

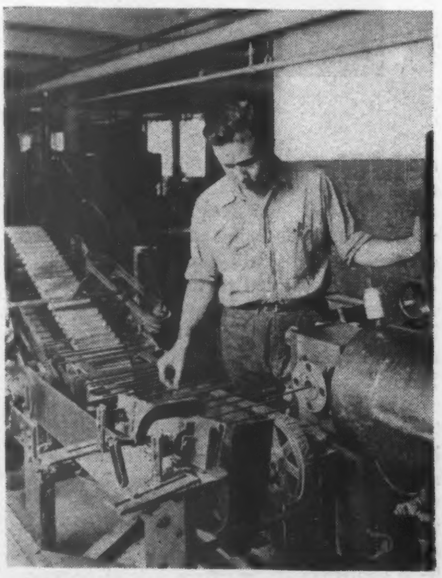
alligator and "C" types are designed to fit nearly every application. Special emphasis is made on lightness in both gun and cable design, permitting the operator to work faster with less fatigue. Spring type or pneumatic balancers are provided for easy positioning of the gun.

Transformers may be with or without tap switch. Electronic control units are available for control of welding sequence, current interruption and, where desired, electronic control of welding heat.

The hydraulic system used makes efficient use of water by means of a fast-acting booster and electro-valve. Corrosion-resistant materials are used throughout.

Machinable Cast Iron Welds

Two welding electrodes have been announced by the International Nickel Company, Bayonne, N. J. One of these, designated the Ni-Rod, is designed for making machinable welds in cast iron. The other,



Coated Ni-Rod electrodes coming from the flux extrusion press—The rods are served into the press from a magazine back of the operator's left hand

called the "133" 80-20 nickel chromium electrode, has been produced for welding the Inconel side of Inconel clad steel.

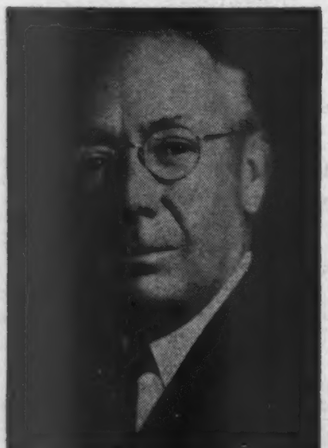
Production follows the same pattern for all types of electrodes and is carried out in automatic equipment, beginning with the mixing of the flux, following through the slug press, loading into the magazine of the flux extrusion press and passage through the new 90-ft. multiple-pass conveyor oven.

Each electrode passes back and forth through the oven, five times, starting from the top and discharging at the lowest level end. Maximum capacity of the plant is in excess of 1,000 lb. of electrodes an hour.

NEWS

W. I. Cantley Retires

W. I. Cantley, mechanical engineer, Mechanical Division, Association of American Railroads, with headquarters in Chicago, retired on December 31. Mr. Cantley was born in Philadelphia, Pa., July 19, 1883, and educated in private schools and Drexel Institute, Philadelphia. He entered the engineering department of the Baldwin Locomotive Works in 1902 and worked continuously until 1915 as draftsman, test engineer, and designer. On November 1, 1915, he was appointed assistant mechanical engineer of the Lehigh Valley and on March 15, 1918, was promoted to the position of mechanical engineer. He resigned from the latter position at the end of 1937 to become mechanical engineer, in charge of research, Mechanical Division, A. A. R.



W. I. Cantley

Mr. Cantley began his service as a member of the Mechanical Division as a member of the Locomotive Construction committee in 1919 and served continuously on various committees until 1938. From 1927 through 1937 he was chairman of the Locomotive Construction Committee. He has been chairman of fourteen special committees on axle research and crank-pin research, specifications for new passenger cars, helical springs for freight cars, journal bearing development, locomotive counterbalance standards, tests of lubricants for roller bearings, development of hot-box alarm devices, A. A. R. automobile decking device, wheel-slide-control devices, tests of refrigerator cars, trucks for high-speed freight service, etc. All activities of these committees, such as laboratory tests, road tests, special investigations, etc., were coordinated under Mr. Cantley's supervision.

Mr. Cantley is also a member of the General Committee, Railroad Division, A. S. M. E., and has served on the A. S. A. War Committee on Standardization of Screw Threads; the A. A. R. Joint Committee on Metric System, and several others. The greater portion of his time was devoted to the special research projects inaugurated from time to time, but he also attended many of their meetings and cooperated with Mechanical Division standing committees, in some instances doing special work for them. He has also been of material assistance to manufacturers of railroad equipment, inventors, individual railroad officers, and others who sought advice or help on railroad mechanical problems.

Baldwin Delivers 3,000-Hp. Diesel to Seaboard

The Eddystone, Pa., plant of the Baldwin Locomotive Works was the scene of ceremonies on December 2, at which the Seaboard's new 3,000-hp. Diesel-electric locomotive was christened "The Railmaster" and the locomotive was accepted by L. R. Powell, Jr., co-receiver for the road, from Ralph Kelly, president of Baldwin.

This is the most powerful single-cab-unit locomotive to be built to date, having two 1,500-hp. supercharged Diesel engines in one unit. While the locomotive is designed for a top speed of 120 m.p.h., the speed restriction is 85 m.p.h. It will be used for hauling the Seaboard's fast freight trains of perishables to northern markets.

The wheel arrangement is 4-8-8-4, with the four-wheel trucks as guiding trucks. The driving trucks, two eight-wheel articulated trucks, have traction motors on all eight axles. The driving wheels are 40 in. in diameter. The light weight of the locomotive is 522,500 lb.; and, with 3,500 gal. of fuel oil, 300 gal. of lubricating oil, 600 gal. of engine cooling water, and 2,500 gal. of boiler feedwater for the train heating boiler, the working order weight is 577,200 lb. Of this, 410,000 lb. is carried on the driving wheels with a loading of 51,250 lb. per axle.

The total wheelbase of the locomotive is 77 ft. 10 in., with a total length inside

Orders and Inquiries for New Equipment Placed Since the Closing of the December Issue

Locomotive Orders

Road	No. of locos.	Type of loco.	Builder
Chicago & North Western	7	1,500-hp. Diesel	Electro-Motive
	4	2,000-hp. Diesel	Electro-Motive
Live Oak, Perry & Gulf	2	600-hp. Diesel-elec. frt. and switch	General Electric Co.
Missouri-Kansas-Texas	7[1]	4,500-hp. Diesel-elec. frt.	Electro-Motive
	6[2]	1,000-hp. Diesel-elec. switch	Electro-Motive
Reading	10[3]	4-8-4 frt.	Company shops

Locomotive Inquiries

Road	No. of locos.	Type of loco.	Builder
Western Maryland	10	4-8-4 frt.	

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Chicago, Rock Island & Pacific	250	50-ton auto.	American Car & Fdry.
	500	50-ton box	Pullman-Standard
Clinchfield	20	70-ton covered hopper	American Car & Fdry.
Canadian Pacific	950	Box	Canadian Car & Fdry.
	50	Box	Eastern Car Co.
	250	50-ton refrig.	National Steel Car Corp.
	500	50-ton auto.	National Steel Car Corp.
Minneapolis & St. Louis	50	70-ton covered hopper	Pullman-Standard
	75	50-ton flat	Company shops
Montour	200	50-ton hopper	Pullman-Standard
New York, Chicago & St. Louis	500	50-ton box	Pullman-Standard
	100	Hopper	Harlan & Hollingsworth
Norfolk & Western	100	70-ton covered hopper	Company shops
Reading	100	70-ton covered hopper cement	Company shops
Southern	1,000[4]	50-ton auto.-box	Pullman-Standard
Timiskaming & Northern Ontario Ry. Commission	600	50-ton box	National Steel Car Corp.
	75	70-ton hopper	National Steel Car Corp.
Wheeling & Lake Erie	6	70-ton covered hopper	General American

Passenger-Car Orders

Road	No. of cars	Type of car	Builder
Canadian National	10	Baggage	National Steel Car Corp.
	5	Mail-express	National Steel Car Corp.
New York Central	200[5]	Sleeping	Pullman-Standard
	112[5]		Edw. G. Budd
	108[5]	Bagg.; bagg.-mail, railway postoffice	American Car & Fdry.

Passenger-Car Inquiries

Road	No. of cars	Type of car	Builder
Union Pacific	100[6]	Passenger	

[1] For delivery late in 1946. Each locomotive will consist of two 1,500-hp. lead units and one 1,500-hp. booster unit. Total cost, in excess of $2,500,000.

[2] For delivery early in 1946. To cost approximately $500,000.

[3] Cost, $1,650,000. To have 70-in. driving wheels and to be capable of operating at a speed of 65 m.p.h.

[4] Aggregate cost approximately $4,900,000.

[5] The 420 cars in this order represent 22 luxurious, streamline sleeping-car trains. They are in addition to the 300 de luxe passenger cars already under construction for Central's daytime trains. The 720 cars are the equivalent of 52 streamliners and represent a total cost of $56,000,000. The 200 sleeping cars to be built by Pullman-Standard will be of high-tensile, low-alloy steel, with welded girder construction. The Budd cars will be of stainless steel.

[6] Part of a program of expansion which will include the purchase of equipment totaling $24,000,000.

knuckles of 91 ft. 6 in. The starting tractive force is 120,000 lb., at 30 per cent adhesion. The locomotive is designed with controls at one end, the opposite end being equipped for coupling, with the conventional diaphragm arrangement.

A.S.M.E. Honors Railroad Division Members

At a luncheon of the A.S.M.E. Railroad Division, held on November 29, during the annual meeting of the Society at New York, six members of the Railroad Division were honored by being advanced from the grade of "member" to "fellow" and suitable certificates were presented by Alex D. Bailey, retiring president of the society. The certificates were awarded to the following for distinctive engineering contributions to the railroad industry: K. F. Nystrom, chief mechanical officer of the Chicago, Milwaukee, St. Paul & Pacific and incoming chairman of the A.S.M.E. Railroad Division; C. T. Ripley, chief engineer, Technical Board, Wrought Steel Wheel Industry; C. E. Brinley, chairman of the board, Baldwin Locomotive Works; W. C. Dickerman, chairman of the board, American Locomotive Company; J. B. Ennis, senior vice-president, American Locomotive Company, and P. W. Kiefer, chief engineer of motive power and rolling stock, New York Central.

A.S.M.E. Railroad Division Elects Officers

At the regular annual meeting of the A.S.M.E. Railroad Division in New York on November 29, the following new officers were installed:

Executive Committee—K. F. Nystrom, chairman, chief mechanical officer, Chicago, Milwaukee, St. Paul & Pacific; W. C. Sanders, general manager, Railway Division, Timken Roller Bearing Company; P. W. Kiefer, chief engineer, motive power and rolling stock, New York Central; B. S. Cain, assistant engineer, Locomotive Division, General Electric Company; J. M. Nicholson, mechanical assistant to vice-president, Atchison, Topeka & Santa Fe; and E. L. Woodward, secretary, western mechanical editor, *Railway Mechanical Engineer*.

General Committee—K. F. Nystrom, chairman; A. A. Raymond, superintendent of fuel and locomotive performance, New York Central; J. E. Davenport, vice-president, American Locomotive Company; H. H. Urbach, mechanical assistant to vice-president, Chicago, Burlington & Quincy; K. A. Browne, research consultant, Chesapeake & Ohio; C. M. Darden, superintendent of machinery, Nashville, Chattanooga & St. Louis; E. D. Campbell, vice-president, American Car and Foundry Co.; E. R. Battley, chief of motive power and car equipment, Canadian National; E. S. Pearce, president, Railway Service & Supply Corp.; W. H. Baselt, mechanical assistant to vice-president, American Steel Foundries; E. P. Gangewere, superintendent of motive power, Reading; C. E. Pond, assistant to superintendent of motive power, Norfolk & Western; C. H. Beck, general sales manager, Westinghouse Air Brake Company; W. I. Cantley, retired, mechanical engineer, A. A. R., Mechanical Division; F. P. Huston, development engineer, International Nickel Company, and R. P. Johnson, chief engineer, Baldwin Locomotive Works.

Miscellaneous Publications

"American Locomotive Went to War." —The American Locomotive Company, New York, has printed the story of its war-time job in a booklet entitled "American Locomotive Went to War." In the booklet, published for its employees, the company contrasts its 1939 dollar output of $22,358,700 and 1940 output of $38,438,900 with a production peak of $428,905,600 in 1943, which was an increase of more than 1800 per cent above the 1939 figure. The booklet tells some of the stories of the achievements of the employees—stories of the production of tanks, tank killers, gun carriages, forgings, ships' masts, shells, springs for submarines and planes and tanks, gun tubes and locomotives.

"Ball and Roller-Bearing Engineering."—SKF Industries, Inc., Front street and Erie avenue, Philadelphia 34, Pa. This is a 270-page book containing some 900 graphs and tables. It begins with a technical description of common bearing types and continues through nine chapters of fundamental engineering studies. Both radial and thrust bearings are discussed in Chapter I, together with data on dimensional proportions, running accuracy, and tolerances of each type. "Forces and Motions in Bearings," the second chapter, is devoted to theory and calculations on such subjects as the nature of rolling resistance, friction torque, friction coefficients, stresses and deformations, load distribution, motion and inertia. Other chapters deal with studies in carrying capacity of ball and roller bearings, bearing selection, design of bearing applications, mounting and dismounting, lubrication and maintenance and bearing failures. The final chapter is made up of tables, conversion values and a description of symbols and abbreviations. Dr. David Palmgren, Dr. Eng., the author, is in charge of SKF engineering and mechanical research in Sweden. The book is a translation and the metric system has been retained, since most of the bearings discussed are internationally standardized in millimeters. For those more familiar with the English system, however, conversion values have been added. First copies of the book are being sent to the heads of leading corporations, technical schools and colleges and the larger libraries. Later editions will be sold at cost to students and others interested in bearing studies.

Supply Trade Notes

Globe Steel Tube Company. — *C. J. Bickler* has been appointed manager of sales of the Globe Steel Tube Company's Los Angeles, Calif., office. Mr. Bickler has been assistant to the vice-president in charge of sales with headquarters in the general sales office at Milwaukee, Wis.

◆

Spicer Manufacturing Corporation.—*L. B. Simonds*, until recently deputy chief in the Tracked Vehicle Section of the Office of Chief of Ordnance-Detroit, has joined the sales-engineering staff of the Spicer Manufacturing Corporation, Toledo.

◆

General American Transportation Corporation.—*William M. Roche*, who has been on leave of absence from the General American Transportation Corporation, Chicago, to serve as a lieutenant-colonel with the Army Transportation Corps, has returned to his former position of special representative in the sales department of General American.

◆

Mt. Vernon Car Manufacturing Company.—*Howard Rushton*, formerly works manager of the Pressed Steel Car Company, has been appointed general manager, freight-car division, of the Mt. Vernon Car Manufacturing Co., a subsidiary of the H. K. Porter Company, Inc.

◆

Carnegie-Illinois Steel Corporation. —*John A. English, Jr.*, assistant manager of railroad material sales of the Carnegie-Illinois Steel Corporation, at Chicago, has been appointed assistant manager of Detroit district sales, with headquarters at Detroit, Mich. *Edward H. Backes*, who has been engaged in sales engineering in the railroad material and commercial forging division at Chicago, succeeds Mr. English as assistant manager of railroad material sales.

◆

American Rolling Mill Company.—*Harry E. Cotton*, formerly city engineer of Omaha, Neb., has been appointed consulting engineer of the American Rolling Mill Company at Middleton, Ohio.

◆

Frederick G. Schranz has established his own office in New York, where he will serve as consulting engineer and manufacturers' representative. Mr. Schranz was vice-president of the Southwark division of the Baldwin Locomotive Works.

◆

American Welding & Manufacturing Company.—*H. D. Malone* has been appointed assistant sales manager of the American Welding & Manufacturing Com-

pany, Warren, Ohio. Mr. Malone since 1943 had been manager of sales of the midwest district. Previously, he had been on the sales and merchandising staff of the Goodyear Tire & Rubber Company.

◆

Protectoseal Company. — *John W. Mock* has been appointed sales manager of the Protectoseal Company of Chicago. Mr. Mock formerly was sales manager of the Turner Brass Works, Sycamore, Ill.

◆

A. M. Byers Company.—*James A. Cain*, formerly assistant manager of the Pittsburgh, Pa., division of the A. M. Byers Company, has been appointed manager of a new division established by the company in Atlanta, Ga., to serve Georgia, North Carolina, South Carolina, Florida, Alabama and parts of Tennessee.

◆

American Car and Foundry Company. —*George K. Bradfield, Jr.*, assistant director of research has been appointed an assistant vice-president of the American Car and Foundry Company. He will assist the vice-president in charge of engineering.

◆

Superheater Company. — *C. A. Leet*, western regional manager, railroad division, of the Worthington Pump & Machinery Corp. at Chicago, has joined the Superheater Company, with headquarters in New York.

◆

American Brake Shoe Company.— *Joseph B. Terbell*, affiliated with various divisions of the American Brake Shoe Company in sales and executive capacities since 1928, has been appointed executive vice-president of the company's Manganese Steel division. In 1940 Mr. Terbell was promoted from a district sales manager's position to a vice-presidency with American Manganese Steel and three years later he was appointed first vice-president.

◆

Edward G. Budd Manufacturing Company.—*Fitzwilliam Sargent*, formerly eastern railway sales manager for the Edward G. Budd Manufacturing Company, Philadelphia, Pa., has been appointed railway sales manager for the company.

◆

American Locomotive Company. — *Duncan W. Fraser* has been elected chairman of the board of the American Locomotive Company succeeding *William C. Dickerman*. Mr. Dickerman has resigned but will continue to serve as a director and a member of the Executive Committee and in a consultative capacity. *Robert B. McColl* has been elected president.

◆

Westinghouse Air Brake Company.— *Sidney G. Down*, first vice-president, and *John B. Wright*, assistant to the president, of the Westinghouse Air Brake Company, retired on December 31.

◆

Union Switch & Signal Company.— *William H. Cadwallader*, vice-president of the Union Switch & Signal Company, retired on December 31.

◆

H. K. Porter Company.—*George L. Green* has been appointed vice-president of the H. K. Porter Company, Pittsburgh, Pa., and subsidiaries. As vice-president of the Mount Vernon Car Manufacturing division, Mr. Green has been in charge of freight-car sales. He will supervise also all sales of Porter, Devine and Quimby products in the Chicago district.

The Porter Company, Pittsburgh, Pa., has acquired the Fort Pitt Spring Company, Pittsburgh, manufacturers of coil and elliptical springs, which it will operate as the Fort Pitt Spring Division. *Henry Miller* will continue as general manager of Fort Pitt Spring.

◆

National Malleable & Steel Castings Company.—*Wilson H. Moriarty*, assistant to the president of the National Malleable & Steel Castings Company, has been elected vice-president in charge of sales. *James A. Slater*, vice-president in charge of railway sales, has retired.

James A. Slater, whose career with National Malleable covered 48 years, will continue as a director and as assistant to president and will act as consultant in railway matters. He started with the company as an office boy in December, 1897, and successively held the position of sales agent, railway sales manager for the Chicago office, assistant sales manager, sales manager, assistant vice-president, and vice-president.

Wilson H. Moriarty is a graduate of Case School (1918). He served as a heavy artillery officer in the first World War. After a training period he became resident inspector at the Cleveland, Ohio, plant of National Malleable and later held similar positions in the East St. Louis, Ill., and Chicago plants. He was appointed chief inspector for all of the company's plants in 1927. Three years later he became sales engineer at the Cleveland plant, and in 1939 sales manager of that plant. In June, 1942, Mr. Moriarty was appointed assistant to the first vice-president, and in 1943 assistant to the president.

Wilson H. Moriarty

◆

Iron & Steel Products, Inc.—*E. D. Connell*, manager of the merchants iron and steel department of Iron & Steel Products, Inc., has been elected a vice-president, with headquarters as before at Chicago.

◆

International Nickel Company.—The International Nickel Company has opened the Cincinnati, Ohio, technical section of its development and research division. *Richard B. Kropf*, metallurgist and former district manager of the Copperweld Steel Company at Hartford, Conn., has been appointed in charge of the new section which will cover southwestern Ohio, the southern half of Indiana, and Kentucky.

◆

Walton R. Collins Company.—*Walton R. Collins*, of The Walton R. Collins Company, 90 West street, New York, has been appointed eastern sales representative of the Malabar Machine Company, Division of the Menasco Mfg. Company, Burbank, Calif., and Joseph Sinkler, Inc., Chicago.

◆

Aro Equipment Corporation.—The following jobbers have been appointed to handle the line of industrial pneumatic tools manufactured by the Aro Equipment Corporation, Bryan, Ohio: Port Huron Equipment Company, Port Huron, Mich., under the supervision of Mr. Charles Kocsis, local division manager in the territory; Dehler Brothers Company, Inc., Louisville, Ky., under G. W. Gille and Sons; Root Brothers Manufacturing & Supply Company, Chicago, under Mr. E. J. Somerville; The Bruce Company, Inc., Fort Smith, Ark., under the McEwen Cherry Company; The Aero Brokerage Company, Fort Worth, Tex., under W. F. Vogel Associates; Delta Equipment Agency, Oakland, Calif., under H. E. Linney Company; and Earl Vinson Auto Parts and Machine Shop, Santa Ana, Calif., Marville Dwyer, Los Angeles, Calif., and M. J. Harford, Los Angeles, under the Burklyn Company.

◆

General Electric Company.—*R. C. Alley* has been appointed manager of the newly formed American Locomotive—General Electric Diesel-electric locomotive division of the General Electric transportation division's apparatus department, Erie, Pa. The new division was formed to better integrate General Electric Company activities with the American Locomotive Company in the marketing of the complete line of Alco-GE Diesel-electric locomotives sold to domestic railroads. Mr. Alley will be responsible for the General Electric's part in sales, application, servicing, and publicity of all Diesel-electric locomotives, electrical equipments, parts, and service sold to railroads under the Alco-GE name. Mr. Alley entered the transportation field in 1929 when he transferred to the transportation equipment test department at Erie. In April, 1930, he entered the transportation control engineering division engaging in the design and application of control equipment for ten years. In July, 1941, he was transferred to the St. Louis, Mo., office and was General Electric transportation specialist in that territory until October, 1945, when he returned to Erie to take over his new assignment.

T. F. Perkinson has been appointed manager of the railroad rolling stock division of General Electric's transportation division at Erie. He succeeds *W. E. Lynch*, who was transferred to the Chicago office as locomotive specialist for the company's central district. Mr. Perkinson will be responsible for the sale, application, and servicing of railroad rolling-stock business. This includes straight-electric locomotives; electrification; electric locomotive equipments; steam- and gas-turbine locomotives; and railroad export business. He also will

handle a.c. and d.c. multiple unit or other electric-car equipments for railroad service, gas-electric and Diesel-electric car equipments, railroad passenger-car and caboose equipment, such as axle-driven generators and control, self-contained power plants, and air-conditioning equipment. His experience with railroad electrical matters began in 1917 when he started as an electrician apprentice in the Mt. Clare, Baltimore, Md., shops of the Baltimore & Ohio. He had worked up to the position of electrician in the Cumberland, Md., back shops when he entered college. After his graduation from Rensselaer Polytechnic Institute in 1924 as an electrical engineer, he enrolled in the General Electric test course at Schenectady, N. Y. In 1925, he was transferred to the transportation equipment test department at the Erie works. From 1925 to 1927 he was assigned to the trans-

R. C. Alley

portation control engineering division and the locomotive division principally on development activities on the then, new, Diesel-electric locomotive. In 1927, Mr. Perkinson was sent to South America as a test engineer for the Anglo-Chilean Consolidated Nitrate Corporation at its Maria Elena plant where a 35-mile main-line electrification had been installed. In January, 1928, he returned to the United States and was associated with Gibbs and Hill on sub-

T. F. Perkinson

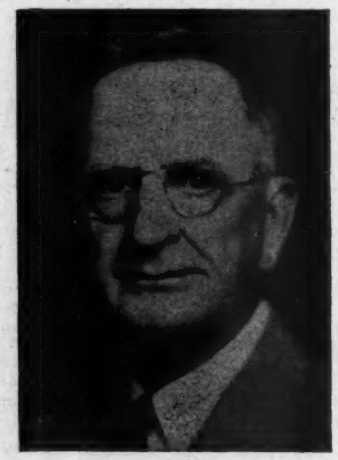
station construction for the Pennsylvania electrification between Philadelphia, Pa., and Wilmington, Del. In May, 1928, he returned to General Electric in the railway engineering department where he remained until his appointment as manager of the railroad rolling-stock division, transportation division, at Erie.

Obituary

John H. Locke, of Bryn Mawr, Pa., a retired executive of the General Steel Castings Corporation, died on November 12. Mr. Locke was 57 years of age. He was a graduate of the Massachusetts Institute of Technology and of Harvard University. He was employed with the Commonwealth Steel Corporation in Granite City, Ill., for many years. When Commonwealth merged with General Steel Castings in 1929, Mr. Locke was transferred to the Eddystone, Pa., plant and was appointed vice-president two years later. He retired in 1942.

◆

Clyde C. Farmer, director of engineering of the Westinghouse Air Brake Company, who retired in 1940, died on November 28, in Pittsburgh, Pa. Mr. Farmer was 75 years of age. For a number of years he was a machinist in the shops of the Southern Pacific and for a period of six months in 1891, was with the Westinghouse Air Brake Company's instructors engaged in the education of railroad officers and employes on all phases of railroad air-brake work. He was appointed supervisor of air brakes for the Missouri, Kansas & Texas in the latter part of 1891 and supervisor of air brakes of the Central of New Jersey in 1899. He helped to organize the Association of Railway Air Brake Men in 1893 and was elected president of the association in 1894. He joined the Westinghouse Air Brake Company as field inspector in 1901 and shortly thereafter was transferred to the Chicago district as mechanical expert. He was appointed resident engineer in 1905 and assistant district manager at Chicago in 1913, continuing as the directing head of engineering matters in the district. He became director of engineering with headquarters at Wilmerding, Pa., in 1919. Mr.



Clyde C. Farmer

Farmer had 532 patents issued in his name. He was awarded the George R. Henderson gold medal by the Franklin Institute of Philadelphia, Pa., in 1938 for meritorious inventions or discoveries in the field of railway engineering. He received the "Pioneers Build America" award from the National Association of Manufacturers in 1940. He was a member of the Air Brake Association, Traveling Engineers' Association, and the Railway Club of Pittsburgh.

Personal Mention

General

Frank J. Quinlan has been appointed engineer of tests of the New York, New Haven & Hartford, with headquarters at New Haven, Conn.

A. R. Snyder, master mechanic of the Union Pacific at Cheyenne, Wyo., has been appointed superintendent of motive power and machinery, with headquarters at Omaha, Neb.

H. J. Warthen has retired as superintendent motive power of the Richmond, Fredericksburg & Potomac at Richmond, Va. Mr. Warthen was born in Richmond on June 16, 1867. He entered his career as a machinist apprentice in the employ of the Richmond & Danville (now Southern). He became a machinist in 1887, then gang foreman and foreman. He subsequently left the R. F. & P. to serve as locomotive inspector for the American Locomotive Company. Mr. Warthen returned to railroading in 1904 as general foreman, locomotive department, of the Richmond, Fredericksburg & Potomac. In 1908, he became master mechanic at the Potomac yard, and superintendent motive power in 1916.

Leslie Steward McGregor, who returned to the Canadian National in August after serving nearly five and one-half years with the Royal Canadian Electrical-Mechanical Engineers overseas, has been appointed mechanical inspector at Montreal, Que.

R. H. Romann, acting superintendent of motive power and equipment of the Peoria & Pekin Union at Peoria, Ill., has been appointed superintendent of motive power and equipment, with headquarters at Peoria.

Leigh Budwell, assistant to superintendent motive power of the Richmond, Fredericksburg & Potomac at Richmond, Va., has been appointed chief mechanical officer, with headquarters at Richmond. Mr. Budwell was born on July 31, 1887, at Roanoke, Va., and is a graduate of the Virginia Polytechnic Institute (1914). He began his railway career in 1905 as a ma-

chinist apprentice in the employ of the Norfolk & Western at Roanoke, becoming a machinist in 1909. He attended school from 1910 to 1914 and then returned to the Norfolk & Western to serve in the test department. In 1915 he became electrical and mechanical inspector, Elkhorn electrification. Mr. Budwell began his service with the Richmond, Fredericksburg & Potomac

Foster Studio

Leigh Budwell

in 1916 as mechanical engineer. During World War I he was a first lieutenant with the Engineers, American Expeditionary Forces. In 1919, he returned to his position as mechanical engineer of the R. F. & P., and in 1940 he was appointed assistant to superintendent motive power.

WILLIAM J. CRABBS, whose appointment as mechanical engineer of the Atlantic Coast Line at Wilmington, N. C., was announced in the December issue of the *Railway Mechanical Engineer*, was born on September 5, 1912, at Hagerstown, Md. He is a graduate of the Virginia Polytechnic Institute (1934) with a B. S. in mechanical engineering. Mr. Crabbs entered railroading in June, 1927, as a special apprentice in the employ of the Western

William J. Crabbs

Maryland, working during school vacation periods from 1927 to 1934. After graduation from college, he joined the American Locomotive Company at Schenectady, N. Y., as a special apprentice, returning to the Western Maryland as a draftsman in 1935. He was advanced to chief draftsman in 1938 and to mechanical engineer in 1940. Mr. Crabbs entered the United States Army in 1940 as a captain, First Military Railway Service, under Brigadier General Carl R. Gray, Jr. He was appointed a major in February, 1943, which rank he maintained until the time of his discharge in October, 1945. Mr. Crabbs' appointment as mechanical engineer for the Atlantic Coast Line became effective on October 15, 1945.

JOHN M. SIKES, whose appointment as superintendent of motive power of the Savannah & Atlanta at Savannah, Ga., was announced in the December issue of the *Railway Mechanical Engineer*, was born on July 1, 1902, in Augusta, Ga. He entered railway service in 1918 with the Georgia at Augusta, Ga., as an apprentice draftsman and later became shop engineer of the Atlanta & West Point, the Western of Alabama, and the Georgia. Mr. Sikes was appointed mechanical engineer of these lines on February 1, 1943, and maintained

John M. Sikes

that position until his appointment to the position of superintendent of motive power of the Savannah & Atlanta.

Diesel

J. E. BOLAND has been appointed Diesel locomotive inspector of the New York Central, with headquarters at New York.

B. C. GONNELL, recently honorably discharged from the United States Army, has been appointed Diesel engineer for the Southern at Washington, D. C.

Master Mechanics and Road Foremen

S. T. KUHN, assistant general superintendent of the New York Central at New York, has become master mechanic at Columbus, Ohio.

J. L. SANTERRE, road foreman of engines of the Canadian National at Rivière à Pierre, Que., has been appointed master mechanic at Levis, Que.

G. E. ALGOE, road foreman of engines, Toledo division, of the Pennsylvania, has been appointed road foreman of engines, Buffalo division.

A. J. HARTMAN, master mechanic of the Middle division of the Atchison, Topeka & Santa Fe at Newton, Kan., has been transferred to the New Mexico division, with headquarters at Albuquerque, N. M.

I. SINGER, master mechanic of the New York Central at Buffalo, N. Y., has retired.

W. C. WARDWELL, master mechanic of the New York Central at Columbus, Ohio, has been transferred to Buffalo, N. Y.

ANDREW H. BEIRNE, master mechanic of the New Mexico division of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., has retired after 41 years of service.

O. J. ROBINSON has been appointed assistant master mechanic of the Nebraska division of the Union Pacific, with headquarters at Council Bluffs, Iowa.

FRANCIS D. DUNCAN, recently released United States Army major, has been appointed master mechanic of the Erie, with headquarters at Avoca, Pa.

L. A. BADER has been appointed road foreman of engines, Eastern division, of the Missouri Pacific, with headquarters at Jefferson City, Mo.

W. L. LONGSTRETH, road foreman of engines of the Buffalo division of the Pennsylvania, has been appointed road foreman of engines—special duty, Buffalo division.

R. E. MCGAHEY, master mechanic of the Baltimore & Ohio, the Pennsylvania, the Richmond, Fredericksburg & Potomac, and the Southern at Alexandria, Va., is retiring after 40 years' service.

H. H. NEAL, assistant road foreman of engines, Fort Wayne division of the Pennsylvania, has been appointed assistant train master-assistant road foreman of engines, Eastern division.

W. A. BIRCH, master mechanic of the Southern Kansas division of the Atchison, Topeka & Santa Fe at Chanute, Kan., has been transferred to the Middle division, with headquarters at Newton, Kan.

W. W. LYONS, master mechanic of the Western division of the Atchison, Topeka & Santa Fe at Dodge City, Kan., has been transferred to the Colorado division, with headquarters at La Junta, Colo.

G. M. LAWLER, master mechanic of the Colorado division of the Atchison, Topeka & Santa Fe at La Junta, Colo., has been transferred to the Southern Kansas division, with headquarters at Chanute, Kan.

G. A. KIDWELL, enginehouse foreman, Potomac yard, of the Baltimore & Ohio, the Pennsylvania, the Richmond, Fredericksburg & Potomac, and the Southern at Alexandria, Va., has been appointed master mechanic with headquarters at Alexandria.

JOHN J. DALY has been appointed master mechanic of the Nebraska division of the Union Pacific, with headquarters at Council Bluffs, Iowa. Mr. Daly, who has been serving as superintendent of motive power and machinery, with headquarters at Omaha, Neb., since February, 1945, returns to the position of master mechanic at his own request.

PAUL H. VERD, who has been appointed master mechanic of the Gary division of the Elgin, Joliet & Eastern at Gary, Ind., as announced in the November issue, was born on April 30, 1908, at Arlington, Wash. He is a graduate of the University of

Washington (June, 1931) where he received his B.S. in electrical engineering. During the summer of 1929 he worked as a surveying party axeman for the Sultan Railway & Timber Company. While studying at the University of Washington he worked part time as a street-car operator on the Seattle Municipal Street Railway, continuing until 1933. During 1932 he also worked part time on developing a method of detecting transverse fissures in rails for a Seattle engineer. In 1933 Mr. Verd became a student engineer in the employ of the General Electric Company at Schenectady, N. Y., and Erie, Pa., specializing in electric and Diesel-electric motive power. In 1935 he became service engineer (Diesel motive power) in the employ of the Electro-

Comm. P. H. Verd

Motive Corporation at La Grande, Ill. He entered the service of the E. J. & E. in 1937 as supervisor of Diesel locomotives, leaving in April, 1941, for active duty with the United States Navy. He had held the rank of ensign in the Naval Reserve from the time of his graduation from the University of Washington in 1931, but had attained the rank of Commander before his release in September, 1945, when he returned to the E. J. & E. as master mechanic at Gary.

Electrical

HAROLD W. WREFORD, electrical supervisor for the Canadian National at Montreal, Que., has been appointed chief lighting inspector for the system.

G. W. AUSTIN, assistant master mechanic, Indianapolis and St. Louis divisions of the Pennsylvania, has been appointed general electrician, Central region.

A. D. MACPHERSON, who has been appointed controller of test and research materials of the Canadian National at Montreal, Que., as announced in the December issue, is a graduate of McGill University where he received the degree of Bachelor of Science in 1916. After holding positions with the Shawinigan Water & Power Company, the Northern Electric Company, and the Canadian Westinghouse Company, Mr. Macpherson began his career with the Canadian National in 1918 as an electrical inspector, motive power and car department, at Montreal. In 1923 he was transferred to the bureau of economics as assistant electrical engineer and in 1926 took

A. D. Macpherson

over the duties of electrical engineer. He became controller of test and research materials in October, 1945.

Car Department

H. L. HEWING has been appointed district general car foreman of the Chicago, Milwaukee, St. Paul & Pacific at Tacoma, Wash.

H. G. MOORE has been appointed assistant superintendent car department of the Atlantic Coast Line, with headquarters at Wilmington, N. C.

C. E. BARRETT has been appointed district general car foreman of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn.

G. W. KISTNER has been appointed master mechanic of the Western division of the Atchison, Topeka & Santa Fe, with headquarters at Dodge City, Kan.

Shop and Enginehouse

S. J. ADAMS has been appointed machinist foreman at the Central of Georgia shops at Columbus, Ga.

L. P. COUCH has been appointed general locomotive foreman at the Union Pacific's shops at Omaha, Neb.

J. M. CROSLEY has been appointed foreman, erecting shop, of the Central of Georgia at Macon, Ga.

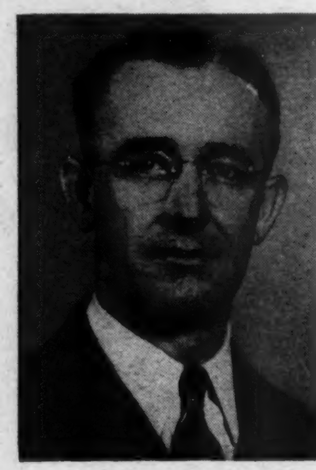
R. M. CULVER, night enginehouse foreman of the Central of Georgia at Columbus, Ga., has been promoted to the position of general enginehouse foreman at Macon, Ga.

B. F. TYNOR, foreman, erecting shop, of the Central of Georgia at Macon, Ga., has been promoted to the position of enginehouse foreman at Macon.

J. A. SCHWILM, assistant enginehouse foreman, Monongahela division of the Pennsylvania, with headquarters at Shire Oaks, Pa., has been appointed assistant enginehouse foreman, second trick, Twenty-Eighth Street enginehouse, Ptitsburgh division.

W. H. CHIDLEY, gang foreman at the Collinwood, Ohio, locomotive terminal, of the New York Central, has become locomotive appliances inspector at New York.

JOHN B. REESE, who has been appointed shop superintendent of the Missouri-Kansas-Texas at Waco, Tex., as announced in the November issue, was born in Waco on April 20, 1908. He attended high school, completing the eleventh grade in 1926. He also had a correspondence course in Diesel engineering with the International Correspondence Schools. Mr. Reese became a machinist apprentice at the Warden shop, Waco, on April 27, 1927. He completed his apprenticeship on September 21, 1932,



John B. Reese

and continued as a machinist until October 16, 1939, when he was promoted to the position of link and motion foreman. He became wheel and box foreman on October 15, 1940; air and brass foreman on May 16, 1941; gang foreman on July 16, 1941; air and brass foreman again on November 3, 1941; general foreman, Warden shop, on June 16, 1944, and shop superintendent on October 16, 1945.

Obituary

CHARLES EDWARD FAIRBURN, chief mechanical and electrical engineer of the London, Midland & Scottish Railway, died suddenly on October 12 in London, England. Mr. Fairburn was born on September 5, 1887. He was a graduate of Oxford University and received the degree of M.A. in 1912. His railroad experience covered the electrification of 49 different railways. In 1934 he became electrical engineer of the L. M. & S. and in 1937 was appointed also deputy chief mechanical engineer. In 1942 he became acting chief mechanical engineer and early in 1944 succeeded Sir William Stanier as chief mechanical and electrical engineer.

E. A. PARK, superintendent of motive power and equipment of the Peoria & Pekin Union at Peoria, Ill., whose death on October 24 was reported in the December issue, was born at North Platte, Neb., on January 22, 1882. He entered railway service as a machinist apprentice in the employ of the Union Pacific at North Platte, subsequently holding several minor positions. In 1904 he became district foreman of the Colorado division at Sterling, Colo.; in the fall of 1908 traveling engineer of the Utah division at Ogden, Utah; in January, 1909, district foreman of the Colorado division at Denver, Colo., and in April, 1913, superintendent of motive power and equipment at Peoria.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

◆

LESLIE PRODUCTS.—Leslie Co., 177 Delafield avenue, Lyndhurst, N. J. Bulletin 451, "Pressure Reducing Valves, Whistles, Temperature Regulators, Pump Governors and Pressure Controllers for Railroad Service." Illustrates, in cross-section, the operation and construction features of Leslie regulators and whistles, and describes their application to locomotives, enginehouses, etc.

◆

"MIDGET MEGGER INSULATION TEST."—James G. Biddle Co., 1211-13 Arch street, Philadelphia 7, Pa.—An 8-page illustrated bulletin describing and giving characteristics of the small 500 volt d.c. self-contained testers now being built in the United States by the Biddle Company.

◆

"ARC-WELDING ELECTRODES."—Wilson Welder & Metals Co., Inc., 60 East Forty-Second Street, New York. 32-page illustrated catalogue supplies complete data on the proper electrodes to use for all types of work on various base metals; describes approved welding procedures for each application, and recommends electrodes for use on mild steel, alloy steels, low-alloy high-tensile steel and stainless steels. Contains also sections on electrodes for non-ferrous metals—aluminum bronze, aluminum and manganese bronze.

◆

EX-CELL-O PRODUCTION PARTS.—Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Mich. Bulletin No. 36151, descriptive of Ex-Cell-O's facilities for manufacturing production parts and unit assemblies.

◆

ELECTRICAL RUST PREVENTION.—Johnston & Jennings Co., 864 Addison Road, Cleveland 14, Ohio. A 12-page bulletin, "Rusta Restor," describes the cathodic electrical method for preventing the rusting of water tanks, piping and other iron and steel structures. Illustrates the principle of such protection with easy-to-understand experiments; describes the equipment required, and includes a table of comparative costs.

◆

HAND AND MACHINE CUTTING TORCHES AND TIPS.—Victor Equipment Company, 844-54 Folsom street, San Francisco, Calif. Victor publication (Form 52); 36 pages; printed in color. Devoted to Victor hand and machine cutting torches and tips.

◆

PAINT SPRAY HOSE.—B. F. Goodrich Company, Akron, Ohio. Catalog Section 4280 on paint spray hose for spraying lacquers and synthetic enamels. Outlines details of construction, with data on sizes, braid type, and weight.

◆

SYNTHETIC RUBBERS.—Hycar Chemical Company, 335 South Main street, Akron, Ohio. Twenty-page illustrated bulletin, "Everywhere in Industry" discusses the process of making Hycar synthetic rubbers, their properties, and applications in various fields, including the railroad industry.

◆

METALLIZING GUN.—Metallizing Engineering Co., Inc., 3814 Thirtieth street, Long Island City 1, N. Y. A 12-page catalogue, printed in color, descriptive of the new features of "The Metco Type Y Metallizing Gun for Production Metallizing."

◆

TOOL BITS.—Vanadium-Alloys Steel Co., Latrobe, Pa. Ten-page illustrated bulletin describes complete line of high-speed tool bits and Lamite cutting tools, with information intended to simplify the selection of the proper steel bit for any application.

◆

ENDURO STAINLESS AND HEAT-RESISTING STEELS.—Republic Steel Corporation, 3100 East Forty-fifth street, Cleveland 4, Ohio. Thirty-two page booklet "ADV. 430," entitled "In War . . . In Peace, Republic Enduro Stainless and Heat-Resisting Steels." Graphically tells of what Enduro did in the war effort and how these wartime applications can be readily translated into peacetime terms.

◆

WELDING MACHINES AND ACCESSORIES.—Air Reduction Sales Company, 60 East Forty-second street, New York. *Catalogue No. 130,* 12 pages, illustrated. Describes a complete line of accessories for all types of arc-welding machines and operations, including electrode holders, graphite electrodes, welding cable, cable connectors, cable lugs, welding helmets, goggles, etc. Section also devoted to Airco Heliwelding equipment for welding magnesium. *"Bumblebee" Alternating Current Arc-Welding Machines,* a 16-page illustrated booklet describing the 300- and 500-amp. standard and the new 200-amp. Bumblebee arc-welding machines, with additional sections on small transformer type a.c. welders, running gear, remote control, and shielded arc electrodes for a.c. welding.

◆

AIR FILTRATION.—The American Filter Company, Inc., Louisville, Ky., "The Magic of Electronics in Air Filtration," a 20-page booklet with color illustrations. Describes the principles and effectiveness of electrostatic removal of dust from ventilating and air-conditioning systems.

◆

TRAIN RADIO.—Maguire Industries, Inc., 1437 Railroad avenue, Bridgeport, Conn. An 18-page booklet, printed in four colors, entitled "Maguire Railroad Radio Communication." Describes applications of the train radio service offered to the railroads by this company.

◆

TRAIN COMMUNICATION.—Bendix Radio, Division of Bendix Aviation Corp., Baltimore 4, Md. An 8-page booklet called Very-High-Frequency Space Radio for Railroad Communication," briefs the history of train communication, illustrates a number of experimental applications, and offers reasons for the use of VHF.